TELEPHONE ENGINEER

Vol. IV CHICAGO, AUGUST, 1910 No. 2

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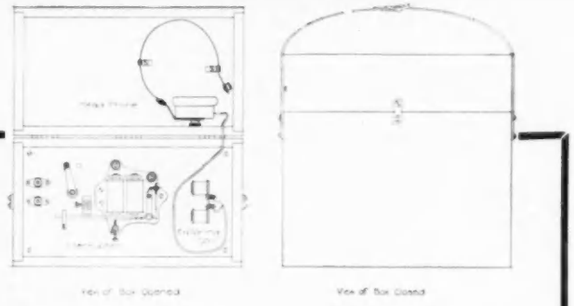

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TELEPHONE ENGINEER

VOL. IV | CHICAGO, AUGUST, 1910 | NO. 2

PUBLISHED MONTHLY BY THE

ELECTRICITY MAGAZINE CORPORATION

MONADNOCK BUILDING, CHICAGO.

ED J. MOCK and PAUL H. WOODRUFF, Editors.

LONG DISTANCE TELEPHONE: HARRISON 3014.

EUROPEAN OFFICE.....36 Maiden Lane, Covent Garden, London
S. RENTELL & Co., Representatives.

Entered as second-class matter May 26, 1909, at the postoffice at Chicago, Illinois, under Act of March 3, 1879.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico.....Per year, $1.00
Canada.....Per year, 2.50
Foreign countries within the Postal Union.....Per year, 3.00
Single Copy..... .20

DISTRIBUTING AGENTS: The Western News Company and its International Branches.

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TELEPHONE TRANSMISSION PROBLEMS.

A TELEPHONE LINE is a low tension, high frequency, single phase transmission line. Its initial voltage is from 20 to 40. Its frequency, varying with the vocal vibrations which actuate it, may be anywhere between 100 and 12,000 cycles, and is figured at 800 cycles for convenience.

In power transmission work 133 cycles is a relatively high frequency. Its problems are sufficient to tempt the most ambitious of our technical graduates into its field. Yet compared to the problems of the 800 cycle telephone current the problems of alternating current power transmission are of the simplest. It is the spectacular rather than the scientific that attracts the scions of technology; the mastery of death-dealing energy rather than the solution of nature's enigmas. There is more science in the Boston-Omaha telephone toll line than there is in Michigan's famous 110,000 volt transmission system.

The only limit to power transmission is line resistence, to overcome which the voltage is raised to the highest practical point; and the leakage consequent upon this high voltage. The limit to long distance telephone transmissions the attenuation, or diminution in amplitude of the wave form; and the interference of higher harmonies or change of phase factor. The diminution in wave amplitude follows a definite law, based on the known constants of line resistance, inductance, capacity and insulation. The change of phase factor is less definite, because it depends upon the presence of indefinite higher harmonics. Were the voice current wave a true sine wave, the change of phase would be inconsiderable in its effects. With the velocities of the waves affected by the higher harmonics, the current form at the receiver may be entirely different from that impressed upon the line by the transmitter. As this distortion is a direct effect of the capacity and inductance constants of the line, it may be modified by counteracting these factors. This is done by Pupin by inserting coils of definite inductance in the line at certain wave length intervals.

In comparing the telephone transmission line to the alternating current power transmission line perhaps we were treading upon dangerous ground. Some of the most serious problems of the telephone engineer are due directly to the proximity of those two types of electrical highway. A high tension a. c. line literally radiates disturbance. When the delicate wave forms of the telephone current come within its field of force, with its violent reversals of magnetic action, the wonder is that the telephone waves have any form left at all.

The most obvious method of overcoming the action of neighboring high tension lines is to keep away from them—five hundred feet or so; and when crossing them to do so at an angle as near ninety degrees as possible. But this cannot always be done. Therefore we resort to

an intensified system of transpositions, calculated to make the induced electro-motive force on the telephone line balance itself.

Under proper conditions this system is quite satisfactory. Unfortunately, however, the telephone engineers cannot control conditions on the power line. The telephone line, both wires being the same distance from the power line, will attain an induced potential equal to that of the neutral point of the power line, which normally is zero. But should any leakage occur on the power line, the potential of its neutral rises in proportion to the leakage. This difference in potential between the neutral and ground induces a static potential on the neighboring telephone wire.

This static potential is equal on both sides of the telephone line, due to the transpositions; hence it is not indicated in the telephone instruments and has no effect on the form of the telephone current. But this condition is rather pernicious than advantageous; for the voltage strain may reach a high point, undiscovered because it is balanced between the two wires of the telephone line. One side of that line must always be a shade less well insulated than the other; and at some point the induced potential breaks down the insulation to ground. The charge on the other side of the line, suddenly made active, discharges through the telephone to the other side and to ground.

It is not the province of this editorial to discuss the solutions of these problems, or the various ingenious methods devised for protecting the telephone line. Suffice it to say that there is still much to be done toward perfecting the telephone transmission line. Those youthful enthusiasts who are even now choosing their careers in electrical work in the seemingly more romantic and picturesque field of power transmission should consider the fact that in its call for real engineering telephone transmission at present holds the palm.

MANITOBA'S MUDDLE.

THE provincial government of Manitoba is having trouble with the telephone business. It will continue to have more than its share of trouble, because it got a bad start. The Winnipeg papers are stirring up the dreadful affair again and much of the old matter is presented in a new light.

Most of us are aware that the government bought the Bell system in 1907, and that the Bell received an exorbitant price for a lot of bad property. In the present controversy it is alleged that O. M. French, the engineer employed by the government, made an inventory of the Bell property in Manitoba, examined and reported upon 67 exchanges, 75 toll offices and 11,000 telephone lines in the record-breaking time of six days. For this phenomenal work Mr. French received $55.95 (Voucher 3467, page 247, Manitoba Public Accounts). Upon Mr. French's finding and recommendation the government bought what the Bell had to offer for $3,400,000. The deal was put through in a hurry, two days being all the time required for the transfer.

Subsequently, Francis Dagger, representing the Roblin political faction, showed that $1,514,322 too much had been paid to the Bell. This estimate was corroborated by Bell figures taken from its balance sheet ten days before the transfer. President Sise, in his annual report, showed that the cost of the company's investment in Canada, including real estate, patents, long distance lines, etc., amounted to approximately $159 per station. Manitoba paid the Bell $232 per station. It is evident, then, that the province was "stuck." It's plant has too much capital account. The charges are exorbitant and even with an unjustifiable rate, no money can be made with its telephone business. In 1908-9 the system showed profit, but it was small and there was not nearly enough charged to depreciation and maintenance.

The problem has grown from bad to worse. The province has a present obligation of more than $7,500,000 represented by a telephone system far from first-class. It is dominated by politics. Rate-payers, by which is meant the tax-payers, are now clamoring that the telephone business of the province should be administered by talent who know how to bring order out of chaos.

DIAPHRAGM VIBRATIONS.

ACCORDING to a writer in the London *Electrical Review*, the commonly accepted idea regarding the manner in which a telephone diaphragm vibrates is that the main seat of vibration lies in the center of the diaphragm. A simple experiment, however, shows this assumption to be wrong.

The experiment consists in placing a receiver in an upright position and strewing sand over its diaphragm in the same manner as for the production of Chladni's famous figures.

Owing to the exceedingly small amplitude of vibration, the ordinary telephone sounds are too weak to make any impression in the sand, therefore it is necessary to secure some device which will produce vibrations of considerable amplitude. Such a device may be improvised from an old electric bell, removing the gong and striker. By suitably loading the armature, which should be a very light one, and adjusting the contact screw, a very definite note can be obtained, which is capable of being altered in pitch between wide limits.

By working this apparatus with a four-volt battery, using a small induction coil to stop up the voltage sufficiently to suit the rather high resistance of the telephone winding, a loud note can be produced in the telephone of sufficient amplitude to set the sand on the telephone diaphragm in motion.

It would naturally be supposed that upon sounding a certain note in the buzzer the vibrations reproduced in the telephone would have their greatest amplitude in the center and that the sand would be thrown to the circumference of the disk in the form of a heaped-up concentric ring or series of rings. This, however, is not found to be the case, but somewhat irregular figures are shown in the sand which, from the forms which they assume, lend little support to the theory that the center of the disk is the center of motion. The sand is thrown away from positions close to the circumference and the diaphragm remains bare in several points which show that many centers of vibration exist. In spite of the fact that the disk is damped all around its circumference, there is little doubt that the diaphragm divides itself up into several vibrating centers.

One would naturally assume that a definite note would always produce a certain definite figure corresponding to the particular form of vibration reproduced in the diaphragm; but there is a discrepancy between two such figures produced by the same note, which requires repeated experiments to discover the

cause of. It is somewhat difficult to keep a particular note constant with the buzzer, as changes take place due to the loosening of the contact screw, introducing differences in pitch which, although they may be slight to the ear, are instantly detected by the dancing particles of sand, and the slight change in the last few vibrations on breaking contact make a difference in the final arrangement of the sand when it comes to rest.

By carefully observing the sand while a note is being sounded, the areas of greatest vibration can be better observed. At the points where there is considerable motion the black disk becomes partially visible, but remains hidden where there is less motion, defining the actual manner in which the disk responds. The slightest change in the note produces an entire rearrangement of the sand particles.

The gradual changing of a note produces remarkable changes. A particular note may produce a certain figure which a slight change will transform into something altogether different. It is exceedingly interesting to watch the rapidity with which the shadowy figures appear, change and disappear, aside from the appreciation of their scientific value. The whole experiment, however, tends to show the extreme complexity of the responsive vibrations of a telephone and leads one to wonder what must be the effect of the human voice, with its harmonies and over-tones, if such wonderful effects are produced by simple notes.

It might be argued that as probably the ear-drum contracts itself into patterns similar to those produced on the telephone disk in order to respond with a similar readiness to the sounds impressed upon it, the nearer the telephone diaphragm approaches in similarity to the human ear drum, the clearer is telephonic speech likely to become.

TELEGRAPH ENGINEERING.

JUST as those engineers engaged in the planning and execution of great electrical power projects have been wont to look with some disdain on the calling of the telephone engineer, the latter has never held in any great esteem the profession of telegraph engineering. The power engineer measures his regard in volts, and has little use for the minute currents of voice transmission. The telephone engineer, on the other hand, finds an attraction in the delicacy of his instruments and the infinite variety of conditions he encounters that he believes is wholly lacking in telegraph work.

It is true that telegraphy is technically simpler than telephony. It is also true that telephony has developed by leaps and bounds, while telegraphy stood still, or advanced but tardily. Nevertheless, in some of its details telegraphy has achieved results which, if they could be applied to telephony, could bid fair to revolutionize it commercially. Whereas, the telephone line is inefficient because of its periods of enforced idleness and its inability to transmit more than one message at a time, the telegraph line has been brought to a very high efficiency in both these respects. Not only is an intensive use of the line permitted through the multiplex systems which have been developed, but the nature of the messages sent over it allow a fine apportionment of traffic which is at present impossible in telephony. However simple the science of telegraphic transmission may appear superficially, we must base our ultimate conclusions upon the results achieved. The telegraph system of the world stands today as one of the greatest marvels of modern civilization.

It is impossible to regard the telegraph and telephone as other than very close allies. In the broadest sense their purpose is identical; yet they are not competitive because the actual service which they render is different. The greatest event of the year's history in both fields was the materialization of the tendency to combine forces. When we consider the investment in outside plant, its similarity in both fields, and the great possibilities in co-operative operation, we wonder how separate operation can be considered at all economical.

The day may never come when telephone and telegraph become synonymous, but from henceforth we can scarcely consider the one without the other.

JACKSON'S VIEW OF DEPRECIATION.

LAST month the subject of depreciation was analyzed at some length, a recent paper by William B. Jackson being quoted as expressing the views of a recognized authority. Some uncertainty may exist, however, as to the proper application of the principles involved, as set forth by Mr. Jackson. It is obvious that while depreciation, in its aggregate effects, demands toll from each year's, despite the fact that its ravages may not be apparent during the first few years' use of of new equipment. This is the rock upon which more than one telephone company has foundered, led astray by the excellence of its new apparatus, and deferring too long the allowance of compensation for inevitable deterioration. We quote further from Mr. Jackson on the subject of applying the principles of the reserve fund:

> Few kinds of apparatus depreciate in value by equal yearly increments, but nevertheless the final effect of decrepitude or obsolescence is to eventually wipe out of the true assets of the company the value of the part less the amount saved by salvage. Such being the case, it will be readily seen that as a piece of apparatus having a useful life of *n* years, for example, will be in service just *n* years, each year of service will reduce its serviceableness to the owner one *n*th part. Its depreciation should, therefore, be based upon yearly increments of one *n*th, in determining the annual contribution that should be made toward the depreciation fund.
>
> Therefore an annual contribution to the depreciation fund should be made such that in *n* years it will accumulate an amount equal to the first cost of the part installed ready for service minus the net salvage, net salvage being defined as the junk value less the cost of removing the part and preparing it for sale, that is, as the net sum recovered. But the annual contributions should draw interest at the usual trust rate for the state in which the plant is located, and the annual contribution to the depreciation account is, therefore, less than one *n*th of the first cost of the part. Thus, if the trust rate is 4 per cent and *n* is 10 years, the actual percentage of the cost that need be set aside annually would be 8.33 per cent of the first value of the part minus estimated net salvage.
>
> The fact cannot be ignored that the people of this country today expect public service companies to be in a position to show that their service is satisfactory and supplied at a reasonable cost, and it, therefore, seems necessary that such companies should be able to know their actual investments in property which represents capital invested.
>
> The coming of public service commissions, having power to regulate the rates of public service companies, has raised the

question whether the depreciation of a plant should have an influence upon the earning power of the company. It seems patent that a company should be permitted to earn a fair return on a full, reasonable, unimpaired capitalization regardless of depreciation, so long as it supplies equally good service. This question would not seem to me to be open to doubt were it not sometimes a subject of serious discussion, and were it not that some respected publicists seem to hold that the net earning power of a public service company should be less after its plant has been subject to depreciation than when brand new, even if it gives equally good service and the stockholders have received back no part of their invested principal, but only fair returns in interest.

With a properly conducted property the fact that the property has suffered depreciation, which is unavoidable in any plant, should not have the effect of injuring the quality of its service or of impairing its capital, which would be the case if its recognized earning capacity were expected to decline proportionally with the increase of its depreciation fund.

If a fair figure has been estimated for the annual contribution to the depreciation fund, this fund will always carry sufficient money to make replacements when required, and as the income from the depreciation fund is used to help build the fund, the owners of the property will not receive returns on their money twice. The investment in the property does not diminish as the plant depreciates, and I do not understand that any one claims that an amount equal to the depreciation may appropriately be distributed to the security holders of the company and thereby reduce the capital outlay in physical property. If the security holders are permitted to receive interest and dividends based upon a fair return on the investment in their property during the first years of its operation, I am unable to see how this basis may be fairly changed during later years, so far as investment is concerned, after the plant has depreciated, as the investment has remained unchanged.

INDISPENSABILITY.

MOST of us are ready to declare the telephone indispensable. What we generally mean, however, is that we could not afford to be without it because the use of messengers and telegrams and postage stamps is so expensive and unsatisfactory and tedious. The telephone makes life better for all of us; but we do not realize that to some it is life itself—some who depend absolutely upon it for their very existence. Such cases may not be common; but even one will show the extraordinary possibilities of the little instrument that is often forgotten entirely until some momentary emergency suggests its use or its insistent signals calls us to relieve it of its message.

Will S. Adams is publisher and editor of the *Chronicle*, a daily paper issued at Marquette, Mich. He secured two hundred subscribers and a good many advertisers for the paper before the first issue went to press, and it has grown to considerable importance in its community.

There would be nothing astonishing in this achievement were it not for the fact that Mr. Adams has not left his couch for sixteen years. This handicap has not affected either his energy or his ambition; but without the telephone neither might ever have got past his bedroom door. With it, he goes after subscribers and advertisers with as much success as a dozen ordinary solicitors with the usual complement of legs.

Every day he fills from five to seven columns, or even more, with local news. He can not go out to gather in these items; and neither will they come to him unsolicited. The telephone is for him the Arabian's magic rug, for it transports him at will to wheresoever he would be, there to gather his news and arrange it without even the bother of returning.

He is no ordinary telephoner, is Mr. Will S. Adams—that you have already realized. During each working day he actually spends more time telephoning than he does on any other one thing. On one occasion, prompted by curiosity, he counted eighty-two outgoing calls in one hour; and that was an ordinary hour, too. Naturally, he wears an operator's head receiver constantly, and uses a special transmitter that is always at his lips.

By telephone Mr. Adams has conducted his daily paper, a monthly magazine, and a weekly newspaper with a circulation of over a thousand, spread over three towns and all secured by wire. By telephone he has also rounded up fifty-two subscribers in two hours and won a generous prize offered by an eastern magazine. One advantage in telephone soliciting, he says, is the immediate response to a request. It is either yes or no in the twinkling of an eye, and the time saved is immeasurable. Doing business by telephone is short, sweet and complete, and given a perfect system and far-reaching service, there is no end to its commercial possibilities.

We all say the telephone is indispensable, but only those like Mr. Adams know the full meaning of its indispensability. To them it is the very staff of life.

TELEPHONING TO LONDON.

THE Associated Press has found material for a hundred-word dispatch in a report that telephone communication between New York and London is now within the bounds of possibility. The occasion for this augury lies in the successful completion of the new Anglo-French loaded cable installation described in the July number of Telephone Engineer.

The new cable is the first of its kind, loaded on the Pupin principle, to be laid in tidal waters. Its success is extremely gratifying to the engineers who planned it, and whose theories met with considerable opposition on the continent because it was believed that a gutta-percha insulated cable had too high a factor of capacity to be successfully loaded with coils. It is interesting to engineers because it is the first installation of loaded sub-marine cable of the armored type, the one laid in Lake Constance in 1906 being lead-covered.

But the distance between Dover, England, and Cape Gris Nez, France, is less than thirty miles. And the distance between New York and Liverpool is more than 3,000 miles. He must be a bold speculator who multiplies his difficulties by a hundred and still sees success in prospect.

Our longest reliable overland telephone line is nearly 1,500 miles. It connects Boston and Omaha, and it is in daily use. But the problems of sub-marine telephonic transmission are infinitely greater than those of overland transmission. The greatest obstacle to long distance communication, capacity, is the very factor which we needs must multiply in the under-water cable.

The Anglo-French cable is peculiar for its mechanical rather than for its electrical characteristics. Much longer loaded cables are already in use, and the Pupin coil deserves all credit for their success. But the trans-Atlantic telephone cable will not come suddenly, and the lay press will have many better opportunities than this to presage its coming before it actually arrives.

A Transmitter for Wireless Telephony

By William Dubilier

IN almost every transmitter thus far conceived the action is produced by the variations of pressure on loose contacts; but the limit is soon reached with the ordinary transmitter, in regard to the amount of energy it will carry. Many difficulties arise when large amounts of energy are utilized. In order to overcome this obstacle several attempts have been made to obtain a stronger effect or change by a number of loose contacts or several diaphragms being affected from the same mouthpiece. In all these cases, however, it was found that where more energy can be varied, distinctness is sacrificed, that is to say, where we increase the number of diaphragms we decrease the clearness of articulation. However, a compromise can be made between the two, and if a proper combination is obtained better results can be had than when a single transmitter is used. In all these combinations, however, and in fact almost every transmitter yet designed, the contacts are generally placed behind the diaphragm and consequently only the increasing and decreasing of pressure on the side of the diaphragm are utilized. In the solid back transmitter a large amount of energy is lost due to the vibration of both the diaphragm and the back in synchronism, that is to say they both vibrate to and fro and in the same direction at the same time.

From this it can be readily reasoned that a large proportion of the vibrations or variations is wasted. Many attempts have been made to overcome this loss, utilizing the vibrations of the diaphragm in both directions by constructing double acting microphones, but none of these instruments have come into general use.

Many transmitters have been constructed with several diaphragms but all of these seem to have the draw-backs mentioned above and tend to make speech inarticulate. In the new transmitter shown here, A. Frederick Collins, wireless expert and inventor of the wireless telephone, tried to combine in an instrument

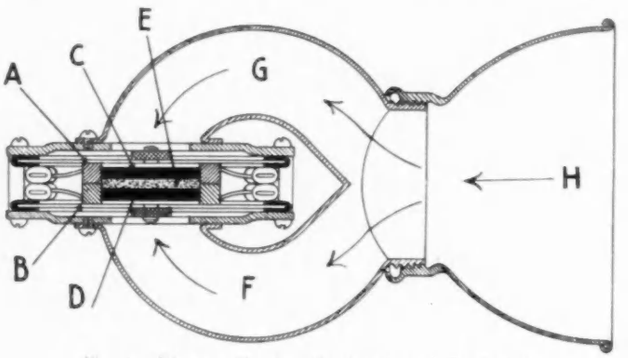


Fig. 1. Diagram Showing Construction of Transmitter.

large volumes of energy and variations of these volumes to such an extent as to make the transmission of speech clear and articulate. With this new transmitter the objection stated above, that in a solid back type the solid back vibrates in unison with the diaphragm, thus decreasing the amplitudes of the variations was overcome by increasing the effect of amplitude of variations to such an extent that in many tests the voice was received four times as loud as when an ordinary transmitter was used, thus making it possible to shunt part of the energy around the transmitter and by varying this part the same effect

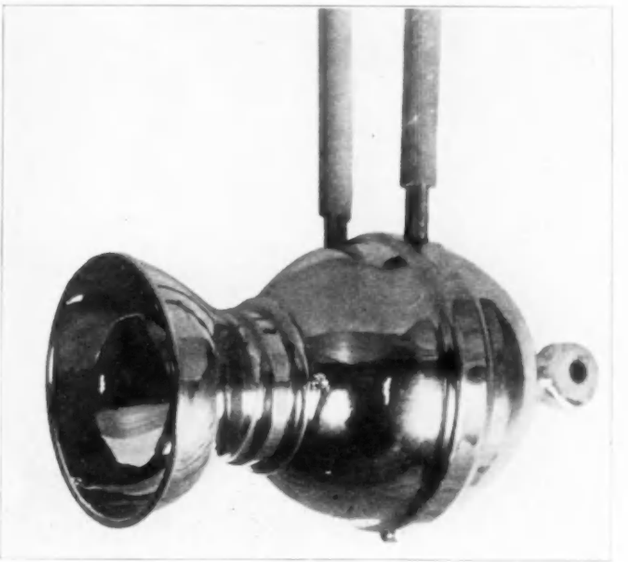


Fig. 2. The New Wireless Transmitter.

can be produced as by varying all the energy through the ordinary solid back type.

This accounts for the very good results obtained by the inventor in his long distance wireless telephone tests, where upwards of eight amperes have been used in the aerial wire system.

The construction of the instrument is as follows:

The two diaphragms *A* and *B* oppositely disposed are rigidly held on the brass frame so that they can vibrate freely. Upon these are screwed the finely polished carbon surfaces *C* and *D*, which form the sides of the cavity containing the carbon granules shown in *E*. These granules form the loose contact between the polished carbon surfaces. To the center of the brass frames are screwed the tubes *F* and *G*, which lead around to one mouthpiece. The vibrations are divided up in *F* and *G* and act on the diaphragm in opposite directions, thus causing these diaphragms to act simultaneously against and away from each other. Thus it may be seen that instead of a single diaphragm vibrating and compressing the carbon granules we have two diaphragms operating against each other and on the same granules producing an amplitude of variation far in excess of that which can be accomplished with a single diaphragm.

Fig. 1 shows a diagrammatic sketch of the diaphragms and the arrow indicates the directions of the vibrations.

The photograph, Fig. 2, shows the construction of the instrument. Many combinations of these instru-

ments have been tried with surprisingly good results. Mr. Collins has constructed a transmitter making the granular holder water cooled by a flow of water, and with this it has been in constant operation for twelve minutes allowing the high frequency current to pass through it, which indicated four amperes on the meter placed in series with the aerial.

During this test there were few variations in the clearness of articulation from the first to the last second, and it proved that it can be used for almost any reasonable length of time.

Fig. 3. Multiple Transmitter Used by Mr. Collins.

As patents are being applied for the details of construction of the water-cooled type cannot be given at present.

Another experiment was successfully tried with four transmitters connected in parallel to be directly in series with the aerial wire system. As the meter on this system showed when the Collins revolving oscillations arc was in operation, as high as 15 amperes were obtained. The four transmitters connected in parallel were placed in series with the ground and used continuously for over 15 minutes for making tests. During this time articles from various technical papers were read and recorded at the receiving end and when compared there were only four mistakes out of two pages of ordinary reading matter. In Fig. 3 the four transmitters are shown with a single mouthpiece. Due to the construction, this is equivalent to eight of the solid back transmitters.

Long distance wireless telephone tests will be made soon with this microphone and with the results already obtained it is believed that the record will be broken for telephony, wire or wireless.

Commission Control in New York State

A law which becomes effective in New York state September 1, 1910, places every telephone line which lies wholly within the state, every telephone line lying partly within and partly without the state, and persons and corporations owning, leasing or operating any such telephone line, under the jurisdiction of the Public Service Commission, Second District, with the exception of corporations, companies, associations, partnerships or persons having property actually used for the public service in the state not exceeding $10,000, or which do not operate for profit.

The commission recently prepared a circular which it has mailed to all telephone companies in the state. Accompanying this circular were blanks to be filled out, giving name, address and other information regarding the company. According to reports received so far there are 1,106 telephone companies in the state, less than one-half of which will probably come under the jurisdiction of the commission, because of the limitations mentioned above.

Arranged according to counties they are as follows: Steuben county has 119; Alleghany follows with 70; Chenango has 62; Delaware, 48; Greene, 39; Broome, 36; Albany, 34; Chautauqua, 32; New York, 31; Columbia, 28; Herkimer, 26; Tioga, 24; Otsego, 24; Wayne, 23; Oneida, 23; Schuyler, 22; Cayuga, 22; Jefferson, 22; and Essex, 20; Chemung, Erie Madison and Orange 19; Onondaga and Oswego, 18; Catteraugus, Rensselaer and Schoharie, 16; Lewis, 14; Tompkins and Yates, 13; St. Lawrence, 12; Ontario, 11; Montgomery, 10; Sullivan and Warren, 9; Franklin, Seneca and Ulster, 8; Clinton, Genesee, Kings, Monroe and Wyoming, 7; Saratoga, Schenectady, and Washington, 6; Livingston, Suffolk and Westchester, 5; Fulton, Hamilton and Orleans, 3, and Putnam, 1.

Rural Telephone Growth Rapid

On January 1 there were, according to carefully prepared figures, some 6,910,000 telephone stations, of which 5,140,000 or 74 per cent, were in what may be called "urban" territory, while but 1,770,000, or 26 per cent, were in rural sections of the United States. So far the comparison, of course, distinctly favors the city argument.

But the story of seven years' expansion of the telephone in rural sections is little less than startling, and while the actual figures of increase in number of stations fall below the city total, the percentage of gain has been altogether in favor of the country. In fact, in 1903 there were but 267,000 rural telephones, so that the increase of 1,503,000 stations to 1,770,000 in the seven years has amounted to a gain of 563 per cent. In the same interval the number of urban telephones has increased from 2,048,000 to 5,140,000, a gain of 3,092,000 stations or 151 per cent.

The most significant thing is that whereas in 1903 there was less than three-quarters of a telephone per 100 of rural population there are today 4.23 telephones per 100 of such population. In fact, telephone rural development has now reached a point where it is actually ahead of the position occupied by the urban telephone development of seven years ago and is 40 per cent as great as present average of 10.7 telephones per 100 in the urban parts of the entire United States.

American Telepraph Engineering

By William Maver, Jr. and Donald McNicol*

ALTHOUGH there may not be any startling technical announcements to make relative to recent progress in American telegraph engineering practice, yet within the twenty-five years past, in common with the progress in other lines of engineering, substantial developments have been also made in the telegraphic art along numerous lines, such as the standardization of equipment, and the adoption of improved apparatus and methods of operation which have generally resulted in increased efficiency of the plant, greater reliability of operation, a more rapid handling of the traffic, and consequent improvement in the service rendered the public; and which developments have, in fact, been adequate to meet the demands made upon the telegraph.

Since Varley there have been many workers whose aim it has been to increase the capacity of a single wire or a wire already in operation as a duplex or a quadruplex by superimposing thereon one or more pulsatory phantom circuits.

In the accompanying diagram (Fig. 1) is shown an arrangement of a "phantoplex" circuit on a quadruplex circuit that is in actual operation in many places in this country and by means of which a "sextuplex" is obtained.

In the figure one station only is shown. G, G' are the sources of e.m.f., for the quadruplex. $P\ C$ represents the pole changer, T the transmitter with its shunt and leak resistances; $N\ R$ indicates the neutral relay, $P\ R$ the polar relay, and $C\ R$, $C\ R'$ the compensating resistance of the quadruplex system the local circuits of which are omitted in the drawing for the sake of clearness. As the operation of the quadruplex is generally understood, it will be necessary only to describe the phantoplex portion of the system. $A\ C$ is a high frequency generator, the circuit of which is controlled by a local relay $L\ R$ and a key K. In the circuit of $A\ C$ is a transformer T' the secondary coil of which is in the transmitting portion of the quadruplex system. Condensers C and C' provide a path for the high frequency currents past the quadruplex relays. t and t' are small transformers, the primary

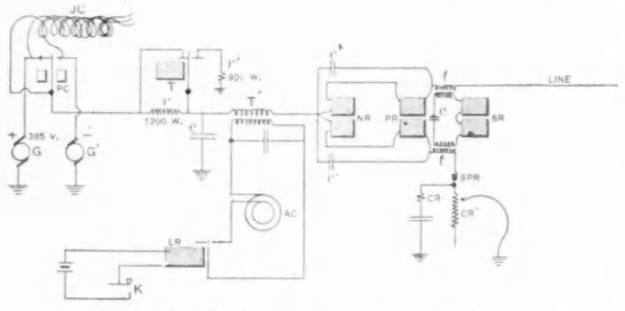


Fig. 1. Phantoplex on Quadruplex Circuit.

of t being in the main line, the primary of t' in the artificial line; and in the secondary circuit of which transformers is the phantoplex polar relay, which in turn operates a reading sounder not shown. This arrangement of transformers t, t' obviously renders relay $S\ R$ irresponsive to the outgoing currents of $A\ C$, but still permits it to respond to the high-frequency currents from the distant station. An unretarded path for the pulsatory currents is provided by a grounded condenser C at each station. The high-frequency currents to the phantoplex circuit are of a strength below that necessary to operate the quadruplex relays, but the armature of the phantoplex relay $S\ R$ being properly biased by spring tension responds to the high fequency currents. Incidentally there is shown in this figure at pole changer $P\ C$ a "coil" condenser $J\ C$ known as the "Johnson" coil consisting of

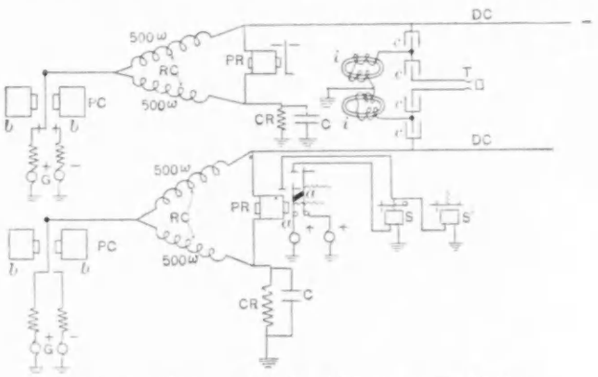


Fig. 2. Simultaneous (Duplex) Telegraph and Telephone.

three separate coils of German silver wire wound on a wooden bobbin with an air core, the spool being about seven inches long and an inch in diameter. The coils are thoroughly insulated from one another by a double covering of cotton saturated with paraffine. One end of each winding is left open, the other end being connected as shown in the diagram. This device is efficacious in eliminating the sparks at the contact points of the pole changer.

In many cases Morse duplex circuits or portions of them are used simultaneously as telephone circuits, the wires of two such duplex telegraph circuits being employed as one metallic circuit for telephonic purposes. One such arrangement is depicted in Fig. 2. Here $P\ C$, $P\ C$ may represent the pole changers at a terminal of two duplex circuits, furnished with e.m.f. by generators G. The Wheatstone bridge method of rendering the polar relays irresponsive to the home pole changer is used, the arms of the bridge being formed of a double retardation coil $R\ C$ which is found to be an efficient, practical device. In some cases the armatures of the polar relays $P\ R$ are equipped with retractile springs so that the polar duplex apparatus may be availed of for simplex operation when desired, which result is accomplished by disconnecting one contact $b\ b$ of the pole changer from a generator. These relays also have double local contact points on the armature levers a, a' shown theoretically in the figure, one of which controls the local reading sounder S, the other sounder S' in a branch office. The telephone apparatus utilizing the two duplex circuits $D\ C$, $D\ C$ is shown at T; c, c, c, c, represent 4 m.f. condensers; i, i are 30-ohm retardation coils. This arrangement of the telephone, in one instance, is used successfully on duplex telegraph circuits to a distance of 360

*Paper read at the A. P. E. E. Convention.

miles, the entire length of the duplex circuits being 1000 miles without repeaters.

Composite circuits (originally the Van Rysselburghe simultaneous telegraph and telephone system) are employed in this country and Canada very extensively; notably by the American Telephone & Telegraph Company, also by the telegraph departments of large railway systems. Between New York and Boston alone at least fifty leased telegraph wires are in daily operation on long distance telephone circuits, and this dual use of circuits is being rapidly extended in telegraph practice, all new line construction being designed with this end in view as noted elsewhere herein, the increased earning capacity of the wires gained thereby being the obvious incentive thereto.

SOME TELEGRAPH ENGINEERING DETAILS.

It might be supposed that telegraph engineering has to do mainly with purely physical and technical questions, but the close relationship existing between the handling of traffic (telegrams, leased wires, etc.) and the machinery employed in handling it, is such that the telegraph engineer, perforce, finds himself involved in the study of traffic details which he cannot well omit without loss to the economies of operation. This for example obviously requires keeping in the engineer's department an accurate record of existing wire facilities, data as to the daily efficiency of operation of all circuits (especially multiplex and automatic circuits) and information as to their electrical condition, together with carefully prepared tabulated records of details pertaining to methods of traffic movement and the amount of traffic handled on the respective circuits throughout the system, in order at once to enable the engineers to determine whether existing facilities are being utilized to the best advantage, or whether additional facilities, or modifications of the arrangement of present facilities may be be deemed advisable. Information of this kind is especially important as a guide in the matter of underground construction and cable work extension. Thorough engineering organization and the application of engineering principles to all work under way or prospective also results, among other things, in placing the engineer's department in a position to intelligently and promptly decide all strictly engineering and related traffic questions that are continually arising in the operation of a large telegraph system.

The graphic method of mapping circuits indicated in the accompanying diagram Fig. 4 to show at a glance the routes of the various wires, their allotted numbers, how operated, offices entered, material of wire, by whom owned, etc., has been found of great utility wherever used. The scheme which is clearly susceptible of many amplifications was probably first employed in the engineering department of the Baltimore and Ohio Telegraph Company in 1885-88 by one of the present writers and it may be of interest to note that details of the nature indicated relating to over 50,000 miles of actual wire were shown on a map four feet long by three feet wide. The accompanying specimens of blank forms for certain reports were also used in the operation of the same company, the information derived therefrom enabling the engineer's department to maintain an intelligent supervision of the circuits, that resulted in a clearly perceptible enhanced earning capacity in the case of numerous circuits. Somewhat contrary to expectations these reports were prepared by chief operators or clerks at no additional expense. As will be readily understood the knowledge that the operation of all circuits was under constant impartial supervision was not overlooked by those directly in charge of the operation of the circuits.

A knowledge of the condition of the insulation resistance and conductivity of every circuit, open or in cables, is manifestly of great importance to the engineering department and reports of the tests of conductors for these properties are promptly forwarded to the engineer's department periodically.

THE TELEPHONE IN ELECTRICAL TESTING.

In America the tangent galvanometer has long since been set aside and simpler and quicker methods of circuit testing and fault localizing have been adopted. Many tests, such as those for insulation resistance and conductivity are now made with high resistance voltmeters, especially where earth currents from adjacent grounded trolley circuits (which frequently indicate an e.m.f. of 15 to 20 volts) are not troublesome. The milliammeter is also used for making insulation resistance measurements not exceeding one megohm and for other electrical tests. The telephone receiver is used as an indicator in many tests. This instrument in connection with an "exploring" coil is largely utilized for localizing faults in aerial cables and in underground cables, especially where the latter are laid in conduits. In making these tests a high frequency current is established in the defective conductor and the exploring coil, a semi-circular coil of fine wire in circuit with the telephone, is moved from point to point along the cable sheath, the indications in the telephone increasing or diminishing as the defect is reached. The telephone receiver as a testing device is particularly advantageous for practical purposes as it places in the hands of the electrical worker or "trouble hunter," an instrument at once portable, and easily understood, and one that is not readily deranged by rough handling. Where a head-band is used to support the receiver, the hands of the workman are free.

For quickly determining by means of the telephone as an indicator the distance of a break in a cable conductor when the insulation is normal, one method is as follows: Select three conductors similar electrically to the open conductor b and adjacent to each other, a, being next to b; c, being next to d and connect as shown in Fig 5. G, is a source of alternating current. For cables approximating 1000 feet in length the generator should give from 40 to 130 volts. The resistance of arm A may require to be 100, or 1,000 ohms. To make this test the four wires should be opened at the distant end. Keys K, K' are then closed and the resistance of arm D or rheostat is varied until minimum sound is heard in the telephone receiver, when:

$$\frac{L\,R}{R'} = F$$

where L is the length of the cable in feet, R, the resistance of arm A, R' the resistance of rheostat D, and F is distance to break in feet.

The Varley and Murray tests are still the standards for making accurate measurements or faults in conductors, and the Wheatstone bridge method for accurate resistance measurements.

POLE LINE CONSTRUCTION—AERIAL VS. UNDERGROUND CONDUCTORS.

Owing to the confusion and general disarrangement of business that usually follows the prostration of the telegraph wires by severe sleet or wind storms in this and other countries, every notable occasion of this kind

has been followed by insistent demands on the part of the interested business communities that measures be taken to prevent a recurrence of these disarrangments. So much has this been the case that in Great Britain, at least, where such storms are quite frequent, and where owing to the gographical shape of the country the loss of telegraphic communication due to the effects of such storms has been felt with peculiar force, these demands have been met by the British government in the laying of an emergency telegraph cable between London and North Britain. The fact that such unanimous demands are made for the prevention of even a temporary loss of the telegraph between important centers is, it may be remarked, a rather notable acknowledgment of the indispensability of this public utility as a part of the commercial and social structure of a country.

Apart from the very important matter of maintaining uninterrupted telegraphic communication regardless of weather conditions in the interests of the general public it may safely be assumed that the various telegraph authorities in this country have not been unmindful of the financial losses sustained by the telegraph upon the occasion of each recurring collapse of poles and wires, and that every possible remedy therefor has been most carefully considered. Furthermore, telegraph lines are not only subject to widespread damage from abnormally severe sleet and snow storms, but are also in many places exposed to the ravages of forest fires, avalanches of snow, washouts due to floods, and to destruction by lightning. Again the average life of a pole line in all parts of the country probably does not much exceed ten years. Consequently, if the financial and engineering difficulties in the way of placing telegraph wires underground on a large scale had not been practically insurmountable, that solution of the problem, unquestionably, would have long ago been adopted. But it is well known, for instance, that the increased static capacity and mutual induction of the conductors carried in cables reduces very materially the length of circuit that may be used in satisfactory telegraph operation. Already indeed the presence of a comparatively limited amount of underground cable in the circuits passing through the principal cities of the country has very perceptibly reduced the speed of signaling, and the general efficiency of automatic and multiplex telegraph circuits in this country. Being therefore aware of the great technical and financial difficulties that would

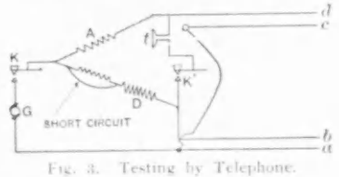


Fig. 3. Testing by Telephone.

attend the placing of wires underground generally between cities and towns over the expansive territory of this country, the question of building stronger pole lines, and of employing larger and stronger wires has been frequently proposed by telegraph engineers. The well known "A" and "H" methods of setting wooden poles have of course received due consideration, and in trials have been found to add considerably to the stability of lines. In addition however to doubling the expense for poles, further objection to the use of these methods, especially where the telegraph lines are on a railroad right of way, is the extra space required for setting, which very often is not obtainable. Another plan tested was that of using worn out track rails, set up in "H" form and braced one foot apart. The cost of setting these rails is, however, rather high, being about eleven dollars per unit. In especially exposed places the plan of doubling the number of poles from say 50 to 100 per mile, has been adopted with considerable success. A reduction of the height of poles and an increase of their girth has also been advocated and there is now a tendency in that direction. It is very probable that pole lines built in the future will when possible be built of poles considerably less than 35 feet in height (the present general practice) with head and side guys located about every half mile regardless of the contour of the line. On heavy

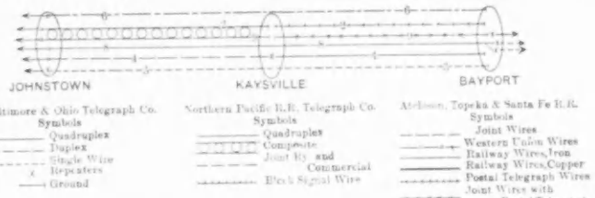


Fig. 4. Graphic Method of Mapping Telegraph Circuits.

loaded lines with the poles set about 100 feet apart reduction of the leverage obviously increases the efficiency of guying. In the construction of a thirty-wire line by using ten-pin cross arms a 25-foot pole would generally leave sufficient clearance.

The employment of reinforced concrete poles for telegraph purposes has been suggested as offering a solution of the problem as regards durability and reliability but has not gained much headway hitherto, principally owing to the present high cost of such poles and also to the excessive cost of transportation. Even, however, if experience should show that cement poles will possess the ability to withstand the strains brought to bear on them by wires heavily coated with sleet, there still remains the unfortunate fact that the wires themselves may break under the strain. It would of course, be a decided gain to avoid the total loss of miles of pole line by the collapse of the poles like bricks in a row—a not infrequent occurrence under present conditions.

In relation to the immediately foregoing remarks, it may not be amiss to digress here to suggest that since the telegraph lines are not put up merely for a day or a year, that a combination of concrete poles, or towers of equal strength and durability with perhaps some form of housing for the wires along permanent and isolated rights of way may be among the possibilities of future telegraph engineering, since such a plan offers promise of reliability of operation without the detrimental accompaniment of impaired efficiency of the telegraph service that follows the placing of telegraph conductors underground. In view of the importance of the subject further reference may here be made to the reduced efficiency of quadruplex telegraph operation within recent years, in some cases amounting to 50 per cent, due to the increased amount of telegraph conductors placed underground in cables in cities. In other cases certain quadruplex circuits have been abandoned because of inductive disturbances from parallel high tension transmission lines. It is a well established fact that prior to the introduction of these disturbing factors, duplex and quadruplex telegraphy in this country had attained a high degree of efficiency. Thus, for instance, it was formerly common practice to operate four, six or more quadruplex circuits between New York and Boston on open parallel lines, each with an efficiency

equivalent to four wires worked simplex, and certain quadruplex circuits between New York and Chicago were operated as a rule with an efficiency of at least 9 per cent.

In the equipment of the quadruplex circuits to which special reference is now made, the ordinary horse-shoe polarized relay, with flat armature, and short cored neutral relay were employed without any devices to aid the operation of the No. 2 side excepting the Edison device of the back contact and repeating sounder attachment to the neutral relay. It is well known also that in isolated sections at the present time quadruplex circuits are still operative at high efficiency. It would appear evident therefore that a restoration of the original efficiency of this exceedingly important arm of the telegraph service would be alone an aim worth the best efforts and thought of telegraph engineers and executives. A return to the former or greater freedom from inductive disturbances would also vastly enhance the opportunities for the utilization of some of the readily available rapid automatic telegraph systems, which as previously intimated the introduction of night letter telegram service may render imperatively necessary in the very near future.

Returning briefly to a consideration of the matter of obtaining a permanent, non-inductive, non-retarding system of telegraph routes, it is clear that utilizing the suggested towers or reinforced concrete poles, with housed wires to afford mechanical protection against storms, incidentally thereby guarding against undue variation o finsulation resistance (a great desideratum for numerous reasons), and by the proper selection of routes at a suitable distance from high-tension lines, thus evading their disturbing inductive currents, an immediate improvement in the operation of circuits would be obtained. There would, however, still remain to be dealt with, the detrimental effects due to the presence of conductors in underground cables leading into and out of cities and towns. This difficulty could, however, be obviated by placing the main operating departments of telegraph offices on the outskirts of such cities, from which offices loops might be run from duplex and quadruplex circuits to the various branch and brokers offices without detriment to the operation of the multiplex main circuits. All wires not required for the actual handling of traffic in a given town would in such cases enter the main operating room on the outskirts of the city and pass on without entering the city proper. In many small towns the telegraph lines following the highways enter at one end of the town and pass out at the other end, a custom that has frequently involved placing a comparatively large amount of cable in an unimportant locality considered from a telegraphic standpoint. By the plan suggested, only wires needed locally would enter the place by the shortest route to the business center, thereby minimizing the amount of cable required for the proper transaction of telegraph business at that point.

It is unnecessary here to comment on the economies and improvement of operation that could be rendered possible by even a partial adoption of the foregoing suggestions, further than to remark that a proper consideration of the subject will show them to be manifold and of great value.

Another Wild Corporation Tamed

The Polk County Telephone Company, capital $5,000, was domesticated yesterday. North Carolina interests are in the concern.—*Columbia, S. C., State.*

Chicago Telephone Investigators Busy

The telephone business of Chicago, from the time there were 200 instruments in the Chicago exchange and a dozen in Evanston, is to be gone through with a fine tooth comb by experts employed by the council subcommittee on telephone-rate revision.

The exact amount received by the telephone company for nickel telephones, party lines and unlimited service instruments also will be determined, and precise operating cost for the different services will be found out and a schedule of rates that will give a fair return on the actual cash invested will be made out.

From beginning to end of the investigation the figures will be compiled as nearly as possible from original sources rather than from the books of the telephone company. It is thought probable that much of the operating data collected by the company during the last few years can be used.

A corps of accountants is already at work on the books and vouchers that the telephone company has placed at the disposal of the investigating committee. Mr. Hagenah predicted that the work will be finished within five months unless difficulties not now foreseen should arise.

The men employed by the city are:

William J. Hagenah, chief investigator, Madison, Wis.; statistician for the Wisconsin railroad and warehouse commission.

Charles A. Honecker, accountant, Chicago; former accountant for the United States Steel Company.

Peter H. Schram, accountant, Milwaukee; on two months' leave of absence from the Wisconsin commission.

William Sloan, engineer, Madison; on two months' leave of absence from the same organization.

A. T. & T. Acquires Michigan State

It is announced that a majortiy of the holders of the common stock of the Michigan State Telephone Company, controlled by the N. W. Harris & Company interests, have agreed to exchange their holdings for the stock of the American Telephone & Telegraph Company on a basis of five shares of the Michigan company's stock for four shares of the stock of the American company. All of the holders of the Michigan State's common stock have the same privilege of exchange on exactly the same basis.

The transaction closes a gap in the American company's line of control and ownership of Bell telephone systems in the United States and will add very much to the strength of the already immensely powerful parent organization.

The Michigan State Telephone Company, according to the last financial statement under date of December 31, 1909, has a plant and property value of $18,738,146. The amount of preferred stock, on which it pays annual dividends at the rate of six per cent is given as $2,285,000. The common stock is $6,000,000, of which $2,500,000 is controlled by the directors. The last dividend paid in June was at the rate of 7 per cent annually. The first mortgage bonds outstanding aggregate $8,666,000.

The company's surplus earnings in 1904 were $132,657 and in 1909 they reached a total of $685,959.

What One Woman Thinks

By Sarah Elizabeth Brown

WHEN I was very little, I remember my grandfather saying that when you have a bull by the ring in his nose the flirt of his tail wouldn't hurt you. The independents claim to have the A. T. & T. Co. by the ring in its nose, but they are making much ado about the flirt of its tail. Every time the aforesaid A. T. & T. Co. buys an independent system, which it seems to be doing occasionally, a howl goes up. If there were no independent systems for sale, none would be sold, and consequently the Bell couldn't buy any, but it is characteristic of most of us to sell anything that will net a profit—the buyer is immaterial. I like to know that the telephone business is good enough at all times to insure a ready market. It is also worth something to know that your own system is maintained upon a high efficiency basis and that if it is good enough for the other fellow it ought to be good enough for you.

* * *

I haven't much sympathy with the line of talk which says the Bell is wholly bad; that if it buys an independent system the community will be put upon a torture rack and the prices will be raised to the point of intolerance. I cannot find anything in telephone literature of late years that warrants such assumption. I have "A Fight With an Octopus" on the top shelf of Obediah's secretary, and while it is a good story, it goes back so far for its blood and thunder that it is something akin to Thomas' Reminiscenses of the Civil War, which I have carefully placed beside Latzke's masterpiece. One of the hardest things the independents have to acknowledge is a rental charge that is now too low. In the beginning, when there was only a little plant, the rate might have been all right, but as the system grew, the rate stood still. Telephone people know that the greater the numbers of subscribers served, the operating expense increases disproportionately, and when the system exceeds the point where it is profitable to operate at a low rate, a higher rate is necessary. In the smaller towns and villages where the telephone company is regarded as an integral part of the community and the councilmen believe in a live and let live policy, the matter of franchise adjustment is an easy matter. Independents have raised rates in many places and if it is found to be necessary they will raise them some more. When a company is promoted honestly with local capital, and the service is kept up to a reasonably satisfactory condition, the franchise problem is no problem at all. We have been through it ourselves, so I know. If a big corporation could hold this near relation to all the people, there wouldn't be such crying need of government control, for after all, government is merely the voice of the people. There are times when it doesn't appear to be so, but if it were otherwise this would be a country of anarchy.

* * *

The National Independent Telephone Association is training states attorneys. It ought to be successful in this for there is much to do. In Kansas, Fred S. Jackson, spurred on by Frank Woods, Theo. Gary and W. P. Hemphill, has brought suit against the Missouri & Kansas Telephone company, because it bought the exchanges at Wichita and Hutchison. In Nebraska, the attorney-general has been asked to oust the Nebraska Telephone Company because it has "secured control" of the independent companies in Cass, Otoe and Sarpy counties. In previous letters I have hinted that the Bell Company operates by the map. I have just consulted Minnie's geography and find that these three Nebraska counties lie along the Missouri river, just south of Douglas, and east of Lancaster counties. The case is parallel with that of the Chicago Telephone Company, when it gobbled up the Interstate at Aurora. Both in Omaha and in Lincoln (Omaha in Douglas, and Lincoln in Lancaster) the independents have beautiful automatic exchanges. This Bell movement is to cut off the outlying connections from the independent strongholds. Down in Missouri the attorney-general is on the trail of the A. T. & T. Co. He wants to be shown, too, because the Bell down there buys a system when it finds one for sale that it can use. I am wondering what some of these independents would do if they couldn't find a buyer?

* * *

Over in Ohio, Frank Davis has readjusted the toll rates of the U. S. Company to the apparent satisfaction of the managers of independent exchanges. The Central Union toll rates, which were slashed a little more than a year ago, have been raised and readjusted under a new schedule. The rate is based as nearly as possible upon three-fifths of a cent a mile. In view of the fact that telephone men of experience have adopted the schedule, it is logical to presume that there is profit in it to them. It also seems to be satisfying the public.

* * *

Roy Mattison has become identified with the Omaha independent system. The Omaha *Daily News* quotes Roy as having said that of the 50,000 telephones alleged by Mr. Yost of the Bell to be part of his system, 7,000 are independent, and will come back into the Nebraska system—independent. Lysle Abbott says that Yost is terribly worked up over the progress independent interests are making, and Yost says the independents are "unduly exercised." All of which sounds like the good old times.

* * *

The "good old times" reminds me, What has become of P. C. Burns? He used to be the bell-wether of the flock, and I fear he has either lost the bell or the clapper, for I never hear anything about him. I never saw Burns in our country but once, and that was when he had Ben Phelps in tow. He was the first man who ever got Ben excited. Burns outlined a common and preferred stock and bond proposition to Ben that suggested the industrial adventurer, but Obediah headed the thing off. Subsequently I saw advertised, over a signature that spelled Burns by inference, something like $300,000 worth of bonds. I fancy that our mutual friend P. C. found some of the gullible ones to

fall for his promotion dope. Seeing how Ben Phelps was all het up at the time, Obediah and I have always had more or less interest in Burns. Obediah is just enough of a farmer to encourage idle talk and telephone salesmen always want to be good fellows, so when the question comes up, which, because of long practice, has become a habit, we always get a new angle on the man from Kokomo. A few years ago, you will remember, the independents were passing condemnatory resolutions on Kellogg. Burns always played his end up good and strong. Anything that would knock the Kellogg was his particular pet. And so we were paralyzed when a drummer blew into our place about the first of November, 1906, and when asked the usual question, told us that Burns was bidding, through the help of Kellogg, on the Detroit installation! Why it was only in June that year that the Burns resolution against Kellogg had passed an International convention. By the very nature of things, Kellogg was barred from bidding on the Home Company's plant. Burns didn't have the facilities to compete with Stromberg and Dean on the Detroit job, but he could get Kellogg to make the stuff if he could land the order. Now, I only have the story third-hand, but I have always taken some stock in it. I have also been pretty strong in my opinion that such alleged "monkey business" has had a lot to do in hurting independent progress.

* * *

I am grinding this stuff on the kitchen table. It stands on the back porch, which is screened in. It is a hot day. The sun blazes through the clouds awhile and then we have a thunder storm. It is great corn weather. Our hay crop was a bumper. The wheat averaged something better than for three years past; the oats were so short we had to mow 'em and rake them into wind-rows and haul them loose to the thresher. They are only a little better than plain chaff, so you won't get any of ours in your breakfasts. Farming is a whole lot less certain than the telephone business. For four years we have shown a monthly increase in telephone subscribers. Collections are always good. There is never anything to knock that crop like the oats got it this year. The late, wet spring delayed the planting and the hot, dry weather prevented the growth. For a time it looked like we would have to use the horse clippers to get any of the crop. But farming pays—if you farm as you run a telephone business that pays. Don't forget that.

* * *

The Michigan State Telephone Company, with its capital of $6,000,000 common and $2,285,000, 6 percent, preferred stock and $8,666,000 bonds, has passed into the hands of the A. T. & T. Co. Boston. The bond the shareholders took A. T. & T. Co. stock four for five, the market difference being only a dollar. The Michigan State makes the thirty-first Bell licensee that is controlled by the American Telephone and Telegraph Company. The common stock was represented by N. W. Harris & Co., and it is especially interesting to observe that the minority shareholders have equal privileges with the majority. This big transfer brings to an end the vicissitudes of the big Michigan operator. The old Michigan Telephone Company defaulted in the payment of interest on its bonds in 1902, when the Harris Company bought it in at foreclosure sale. The reorganized Michigan State has regularly paid 6 per cent dividends on $2,285,000 outstanding common stock, and two per cent was paid in September, 1908, out of the earnings of the previous year. In 1909 quarterly dividends aggregating six per cent were paid, and in June, 1910, one and three-quarter per cent was paid. There are 209 exchanges, 132,270 instruments, and 38,104 miles of toll lines in the system.

* * *

On the last day of May, as I mentioned last month, John Howard, president of the Continental T. & T. Company, was asked to show why a receiver should not assume charge of his $50,000,000 company. It now transpires that the friendly receivership proceedings terminated by Howard relinquishing his high honors. He was succeeded on June 6 by a certain Mr. Hayes, attorney for the belligerent Messrs. Wolf & Koehler, who stirred up the trouble. I haven't heard a thing since, but you may remember that I was sorry for independents generally that this mix-up occurred. On the very same day that the Continental was haled into court, the Consolidated Telephone Companies of Pennsylvania went into receivership. Charles West, of Allentown, and F. D. Houck, of Harrisburg, were named by the court to assume charge. The Consolidated carried a bond issue of two and a half million dollars. It has 1,600 miles of toll lines and 21,000 instruments. The Continental squabble impaired the credit of both the Consolidated and American Union companies. It was claimed that the Continental, having absorbed these properties, was using their revenues for purposes of furthering other consolidations. The receivers of the Consolidated say that the culmination of the trouble is most welcome. Here is where I confess sheer ignorance. High finance is responsible for many surprises.

* * *

On July 2, quite in line with this subject, the National Telephone Company, at Wheeling, a $10,000,000 concern, followed the example of the Continental, Consolidated and American Union. J. W. Ewing and W. C. Handlan will be responsible to the stockholders. It, too, was dragged into deep water by the Continental's alleged mismanagement.

* * *

So, as Dooley says, there ye ar-re!

Chicago Independents Get Exchanges

Locations for four telephone exchanges in Chicago's business district have been secured by the Subway Construction Company, and they will be equipped at once preparatory to going into operatin in less than sixty days.

The matter of securing the locations has been in charge of G. W. Kunstman, acting in behalf of the company. For this purpose Mr. Kunstman has rented the third floor of the Chemical Bank building, at 85 Dearborn street, 60 by 70 feet, two floors in the Chronicle building, at 164 Washington street, and part of the basement in the rear, comprising about 12,000 square feet. Also the main floor of the building belonging to R. J. Gunning at 19 Plymouth place, containing 5,500 square feet, and part of the second floor on the corner of the Brooks building, at the southeast corner of Jackson boulevard and Market streets, containing about 5,000 square feet.

Sending Diagrams by Wire

By H. J. Benedict

THE proposal to transmit drawings or diagrams by wire naturally suggests some form of photo-telegraphic apparatus, especially as so many experimenters are working along that line at present. So, perhaps, it is well to state at the outset that the method of performing this useful feat, as described here, is purely functional to the ordinary duties of telephone or telegraph instruments, and involves with either no special equipment beyond a modicum of patience and accuracy. But for all that it is none the less useful. In fact, it is doubtful if its originator appreciated the extent to which the principle might be made applicable, especially in emergencies.

The system is described by Ralph G. Gaudy, master signal engineer of the Michigan National Guard, in the *United States Cavalry Journal,* as a method of sending sketch maps by telegraph. In his letter Mr. Gaudy says:

"Although efficient military maps of all terrain upon which the army is likely to operate have doubtless been prepared by the War Department, it is frequently desirable, and sometimes necessary for patrols, outposts, cavalry screens, etc., to transmit map sketches to the commanding officers of other units.

"The transmission of map sketches, plans of earthworks, etc., between a cavalry screen and a main body two or three days' march distant may be desirable, as may also be the case between outposts or patrol commanders and superior units five or more miles distant.

"The ordinary method of transmission of sketches by mounted messenger over such distances requires the expenditure of an amount of time and energy proportionate to the distance covered.

"The following method of transmitting sketches has proved practical over the telegraph line of this detachment:

"The only accessory required is the issue of cross section paper in message blank size to accompany the message pads as issued, or better, the printing of such cross section lines on the back of the sheets in the present message pads. The two millimeter appears to be the most practical unit for the cross section paper for this purpose.

"Every point on the cross section paper is determined by a pair of numbers. These numbers, the 'co-ordinates' of the point, serve to locate the point on the paper, using the 'origin' as the point of reference. The 'origin' is ordinarily the lower left-hand corner of the intersecting lines. The first number of the pair indicates the horizontal distance of the point from the origin; the second number indicates the vertical distance from the origin. The two numbers, when written, are separated by a comma; for example, 35,48. The point is then thirty-five units to the right and forty-eight units above the 'origin.' The location of a sentinel, a house, a field gun or any comparatively small object in the sketch is determined by one word and a pair of numbers, for example, 'church 64,83.' Linear features, such as roads, streams and shore lines, are determined by a series of pairs of numbers, which locate successive points along the road or stream. Straight sections of road or stream require but two pairs of numbers which determine the ends of the road or stream. An angular road is outlined by pairs of numbers indicating the successive angles of the road, and a stream in a similar manner. The width of a stream or valley may be determined by expressing its width in cross section units, for example, 'river 6 wide,' the numbers following indicating the center line of the river. Areas, such as villages, ponds, hills or wooded tracts, are determined by a series of pairs of numbers which locate successive points in the outline of such features, thus forming a closed curve. If an area on the map is approximately circular the location of its center and the statement of its radius (in cross section units) is sufficient: for example, 'hill 100 feet high at 26,73 radius 12.' A plateau is determined by stating height and locating the crest line, the direction of the slope being added if necessary.

"To transmit a map sketched on the cross section paper by an observer, the operator, or if necessary, an officer, transcribes the features of the map as explained above. The operator transmits the data over the telegraph or buzzer line or by wireless to the destination. By plotting from the data at the receiving end the map can be reproduced identically, the degree of exactness depending upon number of points set down by the transcriber.

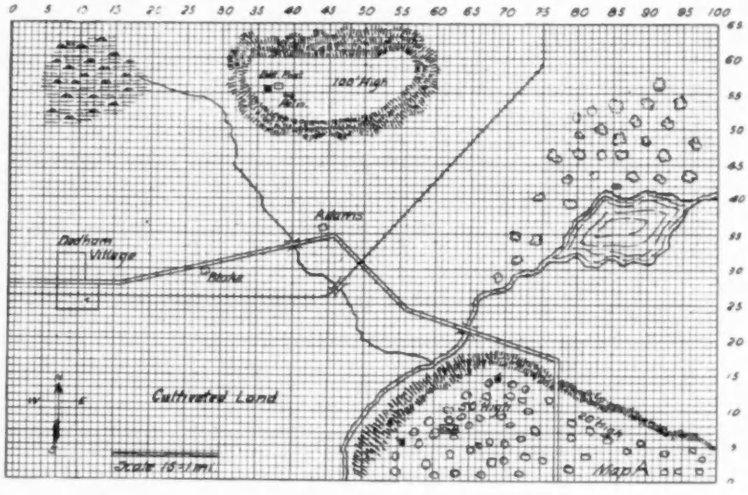


Diagram Prepared for Sending.

"The accompanying sketch serves as an illustration of the method. The transcription required about eleven minutes, the transmission by telegraph about eight minutes, and the plotting about ten minutes; the total time required being a little less than a half hour.

"Data transcribed from sketch for transmission:
"River 47,0—55,14—62,18—66,26—75,31.
"Lake 75,31—84,41—96,39—91,31—75,31.
"River 96,39—11,41.
"Creek 18,57—23,54—43,29—47,25—49,20—60,17.
"Dedham Village 7,32—11,32—11,28—13,28—13,24—7,24—7,32.
"Road fenced 0,28—16,28—46,35—56,24—77,17—77,0.
"Railroad 0,26—45,26—75,59—75,65.
"Plateau 50 feet high timbered 49,0—68,16—75,14.
"Plateau 20 feet high timbered 75,14—100,4.
"Timber 68,28—80,53—93,57—100,45.
"Cultivated land south of Dedham, west of river.
"Marsh radius 6 at 11,57.
"Hill 100 feet high 34,60—55,61—57,57—45,51—34,55—34,60.
"Bridge 64,21.
"Culverts 40,32 and 46,23.
"Adams house 44,36.
"Blake house 28,30.
"Company A 62,8.
"Detached post 9 men with heliograph 37,56.
"Cossack posts 55,6 and 69,15.
"Scale 15 units one mile.

"We find it most practical to use the fractional mark (a dot in the Morse code) to separate the pairs of numbers when a feature requires a series of pairs."

The transmission described was by telegraph. Obviously the telephone would lend itself equally well, if not better, to the work. It would have the advantage of checking by reading back, and would take less time.

A map sketch, such as the one described and illustrated, is perhaps the most evident object of transmission by wire. But other uses at once suggest themselves. For example, a telephone or machinery installer, running into unexpected difficulties, could call up the engineering department of his house, many miles away, and put into its hands a complete and accurate layout of his troubles, receiving suggestions for their remedy in very short order. Railway construction foremen, building contractors, linemen, civil engineers, are only a few of those whose work carries them far from headquarters who might find the system very useful.

It does not require a great stretch of the imagination to conceive of the process being adopted by some clever newspaper man to the transmission of actual sketches of accidents, courtroom scenes, unusual situations, etc. Once reproduced in the newspaper office, the inside artist could use the sketch as a guide in the production of a drawing of real value. An hour at the telephone ought to cover the accurate transmission of a drawing of some pretension; and the only other means of sending such an illustration, the mails, does not compare favorably with the system on this basis.

Some day pictures will be sent over a wire as readily as words or dots and dashes are today. But until that process is developed to commercial efficiency the cross section paper and a little patience can be made to serve very well indeed.

At the first of the year Sweden had one telephone for every thirty-four persons in that country, Germany one to every 71, Great Britain one to every 77, Spain one for every 955, and Russia one for every 1,322.

Ouster Suits Against Bell

Attorney General Jackson of Kansas has filed in the District Court an ouster suit against the Missouri and Kansas Telephone Company and against the American Telephone and Telegraph Company. The court issued a temporary injunction preventing either company from acquiring or absorbing more independent lines until the case is finally settled.

The avowed purpose of the suit is to prevent the building up of a monopoly.

The suit is based on the purchase of the Wichita and Hutchinson Independent Telephone systems at Wichita and Hutchinson last winter by the Bell companies. The Bell companies are said to be negotiating for the purchase of the Union Telegraph and Telephone Company. This company owns local and toll lines covering practically all of Kansas north of the Kaw River and east of Belleville.

The petition filed by the attorney general recites that the American Telephone and Telegraph Company is the real owner of the Bell Company throughout the country.

Attorney-General Thompson of Nebraska is preparing suit to be filed in the supreme court asking an order ousting the American Telephone and Telegraph Company and its subsidiary company, the Nebraska Telephone Company, from the state. It is alleged that the companies have violated the anti-trust laws of the state in the purchase of competing plants from independent operators.

It is stated that the Bell company has purchased, through agents, an independent system aggregating 5,000 telephones. The owners of these companies have been leading members of the state association of independents. The suit is filed at the instance of President Woods of the National Independent Telephone Assocation.

The defendants must make return September 12 at 10 a. m.

Another "Telephone City"

H. J. Pettengill, president of the Southwesetrn Telegraph and Telephone Company, says:

"A bulletin just issued by the American Telephone and Telegraph Company shows that there are 113 cities in the United States with an estimated population of 150,000. These cities have in the aggregate about 2,500,000 Bell subscribers' stations, or approximately fifty-seven per cent of the total Bell exchange subscribers' stations in the country. The total estimated population of these 113 cities is a little over 26,000,000 or about twenty-nine per cent of the total of the country.

"According to the bulletin, Dallas, Tex., has 16.3 telephones per 100 population, which is the largest percentage of any city in the United States; it also shows that Dallas, with the exception of one other city, has the largest percentage of direct or individual lines, and with the exception of one city the smallest percentage of party lines. This is due, the bulletin says, not only to the high character of the citizenship of the city of Dallas, but to the fact that the rates charged for service in Dallas are lower than in any other city in the United States having as large a number of telephones as in Dallas."

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

IF your problem is extremely hard, ask Hulfish. No matter whether your are layman or professional, ask him. And no matter what the problem! Place the broadest kind of interpretation upon those three sentences and you might expect some disappointments, but you will be fooled. David S. Hulfish is an expert at all trades—no jack. You will not be able to find his equal in your longest journey.

His whole name is David Sherrill Hulfish. He got his middle name from his mother, who before marriage was Dora Sherrill, native of Tennessee. Hulfish says that his middle name serves him in three ways—first, as a constant reminder of his mother; second, as a *nom de plume;* and third, people don't ask him why he hasn't any.

If you would go to the Hulfish home—for he has that, with a wife and son—you might find him seated at the piano, his right hand purling over a figuration of *Auf dem Wasser zu Singen;* but his mind, like as not, would be engaged with the latest kink in color motography. His business card would say: "Thirteen years a telephone engineer—five years a solicitor of patents." He is at present chief engineer of the Canadian Machine Telephone Company, Ltd., Toronto, Canada. You have a hint of six occupations already, but this is not a tabulation.

An Expert at all Trades.—No Jack.

Hulfish was born May 6, 1873, in a corner of his father's printing office—that portion which served as a home. The place was Owensville, in the county of Gibson, state of Indiana. How natural then that he is a printer, a pressman, a proof-reader and a bookbinder. He got these things while he attended Owensville's school—there was only one school in Owensville and it was in luck to have that. But the country weekly came out every Friday and there was always some job work to do. Before Hulfish could pull the Washington he could roll for it and wrap the single list and kick the Gordon—all of which he did. And when the Owensville school had nothing more to offer, Hulfish took some money that he had miraculously saved and went to Greencastle, where he entered the De Pauw University for the freshman year with Latin back. He spent two years at De Pauw studying mathematics, physics and the languages. They were the bulliest years of his life, for he could everlastingly dig into things. No attempt was made to follow the regular college course and no degree was sought. He was there to qualify for engineering work—for electrical engineering in particular. De Pauw was as good as any other place for acquiring this, for it was not taught then as it is now. And Hulfish studied then as boys do not study now, which made it possible for him to take all De Pauw had to offer in the two years that he was there.

He came to Chicago, where he promptly recognized that a stenographer had more opportunity of making an engineering connection than a rawboned, lank and lean Hoosier had with only school knowledge to help him. So he bought the Pitman books and by their aid he equipped himself for a fifteen dollar a week stenographic position. It took him six weeks to do this, but he didn't miss a day's work. When you are needing an exceptionally efficient stenog. or a world-beater typist, you might do far worse than get this man. The stenographer stunt gave him his chance to search for that engineering job, which he found with the Central Union Telephone Company in 1896, where he engaged as assistant engineer, working under Samuel G. McMeen, who was the company's chief. Hulfish continued in the service of the Central Union for more than five years before he broke loose and became engineer for the Baird Manufacturing Company, where he designed and supervised the manufacture of telephone apparatus with particular reference to pay-stations, both for manual and automatic systems.

It was during his connection with Baird that Messrs. McMeen and Miller formed their co-partnership and opened offices in the Monadnock building, and it was about then that Hulfish joined forces with them. His duties consisted of the preparation for drawings and specifications for patent applications, chiefly of inventions pertaining to telephony, and assisting his employers in the formation of opinions and in studies involving patents and apparatus. He invented some things of his own while going along.

Hulfish isn't a faddist. Everything has interest for him, but the things that interest him most are thoroughly analyzed. He bores straight through the "mystery" to its foundation, separates the troublesome elements and assigns each to its proper place and then tells you how simple it is. He is a photographer, a book-keeper, an electrical expert, an astronomer, a text-book writer—always on technical subjects, a musician. He is always proficient in the thing least expected. An acquaintance covering a string of years will never get to the bottom of Hulfish. No one knows him intimately. He is everything but a mixer. He never courts familiarity with his fellows. His associates all swear by him, because he is most valuable to them. He will always lend a helping, do it quietly and quickly and blush like a girl at a compliment. And there is nothing vainglorious about him. The proverbial "plain as an old shoe" would be a decoration if it was meant for this modest Dave. But nobody calls him that. Nobody calls him David. He is Hulfish. The Chicago directory is full of Hulfish, but they are not his kin nor his kith—he isn't that kind of a fish. Incidentally he don't know how to fish. It is his notion of nothing to do.

Telephone Engineer has just completed a long series of articles or a series of long articles entitled, "How to Read Telephone Circuit Diagrams," by David S. Hulfish. They have made a hit with an army of studious young chaps who will some day be running down the trouble in America's great telephone system. If you have followed these articles you will have had a glimpse into the brain that produced them. It is a sample of the Hulfish work which will shortly issue as a book. To the technically uninitiated it will be delightfully fascinating, but to the ambitious student, it will be a nine-course dinner, with sherbet and cigarettes.

So, then, all of you who are feeble-minded, ask Hulfish. Get the habit. If he tacks on a modest assessment for his answer, think it over before you squeal, for it is a compounded cinch that his answer will help you over the hard spot and save your time. If it is exceptionally hard for you it will be easy for Hulfish. Ask him. That is part of his business.

Department Store Has Night Service

An all night telephone shopping service has just been installed by Wanamaker's department store in Philadelphia. The plan was placed in operation after a conference between the store managers and the contract department of the telephone company at Philadelphia.

"Can you give us the service?" asked one of the store managers, after the proposed plan had been explained to the telephone people.

"Yes," replied the contract agents. "Give us time to adjust our switchboards at your store and we can handle the business for you."

Arrangements were made for an extra force of operators at the store and the plan was put in operation without a hitch.

The following is how the new service is described by the store managers:

"When the evening mail brings a letter which invites you to an automobile drive the next day, don't say, 'Pshaw! I have no automobile veil or bonnet!' Just go to your telephone at any hour of the night, call 'Grammercy 6900, please,' and ask for the mail order section and tell us what you want and your order will be promptly delivered.

"If the dressmaker is to come tomorrow morning, and you have forgotten hooks and eyes and cotton or pins or needles, or the lining, or some embroidery or lace, telephone at 12 o'clock at night or at any hour and they will be sent to your house by the first delivery in the morning."

The new service is especially valuable to travelers, say the store people. Many times a message which requires quick departure is received by persons late at night. By the all night service it is possible for any articles or wearing apparel to be ordered at once and delivered at an early hour. Orders have been received at the store as early as 5 o'clock in the morning and have been sent out on the first delivery.

Full credit is given by the store management to the telephone service which makes the arrangement possible. The success of the venture, the managers say, rests upon the service.

Postal Alliance With Independents

Negotiations between the Postal Telegraph-Cable Company and the Kinloch Telephone Company at St. Louis forecast such arrangements for using each other's wires as exist between the Western Union and the Bell, although there will be no financial alliance.

By this traffic arrangement both companies will be able to extend their domains of service. Illinois, Indiana, Iowa, Missouri, Kansas, Kentucky, and Ohio are involved in the plans.

The Postal Company has obtained an injunction against a subsidiary Bell company in New Mexico for violation of a contract which the Postal company made with an independent telephone company last July for five years, by which the Postal company reached a number of towns in New Mexico by an extension of its service from El Paso to Silver City, New Mexico. The contract still has more than four years to run. A few weeks ago the New Mexico subsidiary Bell company bought out the independent telephone company with which the Postal had this contract, and then the subsidiary Bell company notified the Postal that the contract would be repudiated July 1st and connection cut off.

The Postal company has obtained an injunction against such repudiation from the district court at Silver City, New Mexico, and has set forth that the action is due to a conspiracy between the Western Union and the Bell Telephone Companies to suppress telegraphic competition between El Paso and Silver City and intervening towns and other parts of the country.

The Constantinople Concession

It is stated that the telephone concession for Constantinople, which was granted to the British syndicate through its representative, Herbert Laws Webb, some time ago, has been ratified by the Council of Ministers, and that the contract will be signed by the Minister of Finance in Paris within a short time. The concession is for forty years, with the privilege of purchase by the government at the end of ten years, but the installation must be completed within two years. Among the companies interested in the enterprise are The Thompson-Houston Company, the National Telephone Company and the Western Electric Company.

The Telewriter Exchange at Walbrook

By R. White Lindsay*

ALTHOUGH the telewriter has been more extensively used in America than in England, the credit of inaugurating the first telewriter exchange belongs to the latter country. This exchange which is at present only connected to about fifty subscribers, but contains provision for connecting up a further 750, is situated in the offices of the National Telewriter Company, Bucklersbury, London.

Since the telewriter has been employed to a limited extent for many years in England and the United States, it is rather surprising that its use has been restricted almost entirely to these two countries, the more so as the many advantages of the telewriter should appeal forcibly to certain sections of the public. As the instrument has not been prominently before our readers, it may be as well briefly to explain the principle on which it works.

The main principle employed in the telewriter is that of producing two independent motions by the movement of the transmitting pencil, each motion causing a change of current in a circuit. At the receiving end these two varying currents produce independent motions, the resultant of which is a reproduction of the movement of the transmitting pencil.

For transforming the motion of the transmitting pencil into the rotary motion of two shafts, the arrangement diagrammatically shown in Fig. 1 is adopted. Each of the shafts shown has rigidly attached to its lower end a lever carrying a contact connected to one of the two line conductors. This roller

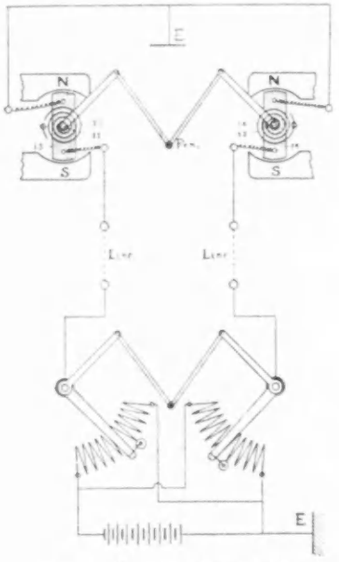


Fig. 1. Diagram of Telewriter.

passes over the contacts of a rheostat, thereby varying the current flowing in the line, the earth serving as the return conductor. At the top will be noticed the receiving apparatus, the moving coils of which are controlled by springs, and take up a position in accordance with the current flowing in each circuit. By connecting the receiving pen to the shafts by a link motion, the motion of the transmitting pencil is thereby produced.

The paper is fed at the same instant at the receiving and sending stations, at the latter mechanically and at the former electrically. In Fig. 2 (left-hand side), which shows an interior view of the transmitter, will be noticed a finger lever *O*, connected at its inner end by a rod to the paper shifter *P*. When the lever *O* is moved to and fro between its stops, the paper shifter rocks to and fro and feeds paper over the platen *Q* at each movement. Actuated also by the lever *O* is a switch which, when closed, operates a relay at the receiving end and feeds the paper forward one step. The relay *R* (Fig. 3) also controls a circuit which includes the field magnets *W*, *X* and the pen-lifter *Y*.

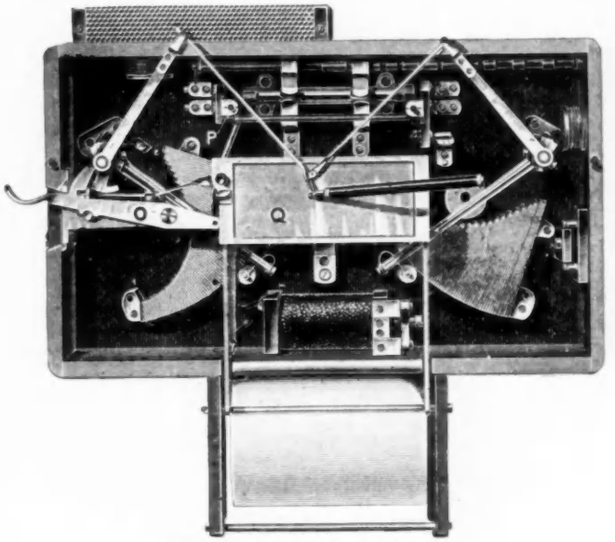


Fig. 2. Interior of Transmitter.

At the transmitter, movements are made both on and off the paper, and it is necessary to provide means for raising and lowering the receiving pen accordingly. This is accomplished by sending a superimposed alternating current over the lines. Referring to Fig. 3, *J* is the hinged platen over which the transmitter paper passes. It is held in its upward position by spring *K*, and is brought to its downward position by the pressure of the operator's pencil in writing. In the latter position contacts are closed at *L*, which completes a circuit through the break and primary winding of an induction coil, *M*. This coil has differential secondary windings, *a* and *b*. These are included in the line circuits, but in relatively reverse directions, so that at any given moment the induced current in one line will be in the opposite direction to that in the other; *c* and *d* are the windings of a choke coil also in the line circuits, the function of which will be referred to later. It will be seen that whenever the operator's pencil is "on" the paper the induction coil *M* is brought into

The Electrician, London.

operation, and an alternating current induced in the secondary windings is superimposed upon the writing currents passing through the lines. At the receiver this alternating current passes through the differential windings of a vibrator, *N*, and the moving coils, *O*, *P*. The vibrator has over its core a reed, *e*, upon which rests a weighted lever, *f*, the contacts of which shunt the winding of the pen-lifter *Y*. When the transmitter platen is depressed, the current from the induction coil *M* causes the reed *e* to vibrate. This increases the resistance between the contacts of *e* and *f* to such an extent that current passes through the winding of pen-lifter *Y*, causes its armature to be attracted, and allows the receiving pen to rest upon the paper. When the induction coil *M* is inactive, the contacts of the vibrator *N* are at rest, forming a shunt of such low resistance that the pen-lifter *Y* is inert. Under this condition, a spring moves the armature of *Y* forward, and thereby raises the pen from the paper. To prevent disturbance in neighboring circuits, the alternating current is confined to the lines by means of the condenser *U* and choke coil *V*. The condenser forms a path for this circuit, and the inductance of *V* prevents it passing to earth.

The receiving pen, when not in use, is held in the ink well by the rod *I* (Fig. 4). It is also brought to this position every time the paper is shifted, and is thus kept fully supplied with ink. The line currents are taken from a small secondary battery, which by a switch (operated by the finger lever *O*, Fig. 2) is connected to and charged from the electric light supply when *O* is in the receiving position. When the transmitter is in use this switch disconnects the battery from the lighting supply and connects it to the rheostats. The instruments are calibrated for circuits of a fixed resistance, and the lines are made up to this with added resistance.

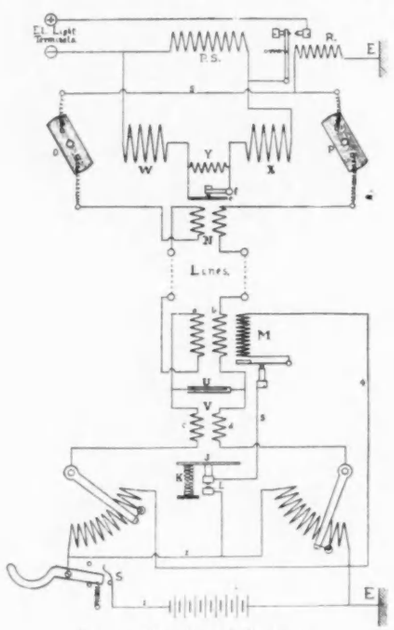


Fig. 4. Interior of Receiver.

The switchboard installed at the Walbrook exchange is operated in identically the same manner as an ordinary telephone board, the subscribers telling the operator the number required by means of the telephone hanging at the side of the instrument.

An important feature of the telewriter is that no attention is required at the receiving instrument, so that messages are delivered in the absence of the addressee, and are read on the latter's return. In this connection it is important to note that the first action of the transmitting instrument is to move the paper at the receiving instrument, so that a clear space is always available. It may also be mentioned that, when requested, the British postoffice will arrange to forward telegrams to telewriter subscribers by means of these instruments, thus saving time in delivery. Subscribers may also send their telegrams by telewriter to the Central telegraph office.

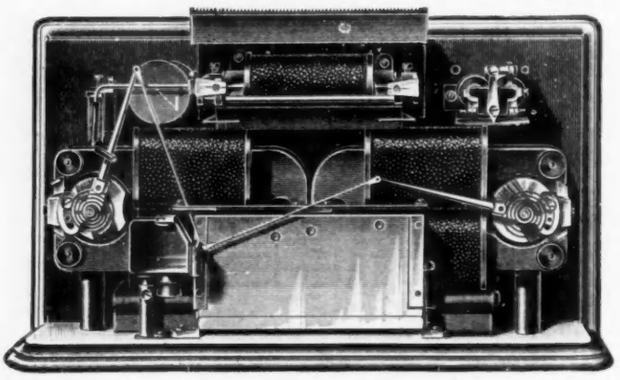


Fig. 3. Telewriter Circuit.

As to the advantage of the telewriter, these are obvious wherever numbers and prices have to be transmitted between offices, a written record being obtained by its use; whilst a business man is able at a glance to see all those messages which have arrived during his absence, and any replies that have been given, a permanent record being thus obtained of all transactions.

Wireless Improvements

H. Grindell-Matthews has introduced important improvements into his wireless telephone system, which does not require poles or towers. The large drums formerly used have been done away with and the new transmitter-receiver is a compact instrument. Mr. Matthews has succeeded in speaking a distance of seven and three-fourths miles on sea, and has also spoken from a motor car traveling at the rate of forty-five miles an hour, to a point half a mile away, in a busy part of London. He has also succeeded in transmitting speech through the steel walls of a strong room. He will next make an attempt to speak from Cardiff to Chepstow, England.

Telephone Girls to Organize

Telephone girls throughout the United States are to be organized by the Commercial Teelgraphers' Union of America and Telephone Operators' Association. This is the new name adopted by the telegraphers in their convention recently. SecretaryTreasurer Wesley Russell was instructed to take up the organization of the telephone girls in Chicago immediately.

History of the Bell System*

IN spite of repeated attempts to make known the real facts of the early history and evolution of the Bell system, there seems to be still much misunderstanding.

At the risk of being prolix, and of repeating what has often been told the history and evolution and development will be retold as briefly as possible.

The telephone was first introduced to the public in 1876, and put to the first practical or commercial use in 1877. During that year was organized the first "association" or "company" to hold the patents. The first companies systematically to exploit the business were formed in 1878, one for New England, and one for the rest of the United States and Canada. These two companies succeeded to all the rights and property of the original association. The capital, $650,000—6,500 shares at $100 par each, represented the patents, such rights and property as had resulted from the time and money expended up to the spring of 1878, and in addition $100,000 in cash.

Early in 1879, these two companies were consolidated into one company, the National Bell Telephone Company, the first company to attain any prominence.

The capital of this company was $850,000—8,500 shares of $100 par value each. $650,000 in shares was given share for share for the stock of the two old companies and $200,000 in shares left in the treasury. The treasury stock was sold as the company required the money, for the best price obtainable. The $200,000 par yielded to the treasury $430,000 in cash, an average of $215 per share, the last 500 shares having been sold for $600 each.

It was during the existence of this company that the permanent foundations were laid upon which is built the present comprehensive system.

It was in the fall of 1879, that the settlement was made with the Western Union Telegraph Company which removed the most formidable and powerful competitor from the field.

It was during this period that those fancy flights in the prices of the stock took place, the $100 shares (of which there were only 8,500) being quoted at one time at $1,000. Few, if any, transactions took place, however, at this price or anything near it. The sale of 500 shares of the treasury stock at $600 per share was probably about the best price at which any considerable transaction took place.

The stock of this company was fairly well distributed among 338 holders, an average of about 25 shares each, twelve holding in lots of 200 shares or over an aggregate of 4,795 shares out of the 8,500 shares.

At the highest quotation the total market value of all the shares of the company would have been $8,500,000. According to the popular belief, over twelve of the original investors have been credited with realizing, if not more, at least as much as this.

No dividends were paid by this company.

The rapid increase in the business called for more capital. Early in 1880 the American Bell Telephone Company was organized and the business of the National Bell Telephone Company transferred to it. The shareholders of the National Bell Telephone Company were given for each share of their stock six shares of the new American Bell Telephone Company stock. 8,500 shares of the treasury stock were at the same time sold at par.

At the close of 1880 there were 540 holders of the 59,500 shares, an average of 110 each. Twenty holders of 500 shares or over had in the aggregate 33,190 shares. This was the last year that a majority of the stock was closely held.

In 1881 the first dividend was paid.

The American Bell Telephone Company continued the business until 1899, during which time the capital stock had increased from $5,950,000 to $25,886,300. The $25,886,300 capital was held by 6,961 shareholders. 62,649 shares were held by 61 shareholders in blocks of 500 shares or over, while the balance, 196,214 shares, was held by 6,900 holders.

The increase in the stock had been sold for cash at various times, yielding the company more than enough in premiums above par to offset the shares that had been issued for patents, inventions, and property of the National Bell Telephone Company.

When the American Bell Telephone Company transferred its business to the American Telephone and Telegraph Company there had been over $28,000,000 actual cash paid into the treasury of the company by shareholders as against $25,886,300 capital outstanding. During the time no stock dividend or dividend of surplus in cash to pay for stock issued was made.

The market price of the American Bell Telephone Company shares during the year ranged above $200 a share. The company was paying 15 per cent dividends yearly.

The demands of the business required much larger capital than could be provided under the corporate powers of the American Bell Telephone Company. The American Telephone and Telegraph Company, a company organized to operate the long-distance traffic, purchased the business in 1899. The consideration was cash, but in effect the shareholders of the American Bell Telephone Company received two shares of the American Telephone and Telegraph Company for each share held. The dividends were put on a 7½ per cent basis and were increased in 1906 to 8 per cent, at which rate they still continue.

Since 1900 the stock of the American Telephone and Telegraph Company has been increased from time to time as the business called for money. At the close of 1909 there were in the hands of the public $256,475,300.

So much of this stock as was not sold to the shareholders at par was sold for cash at a premium, the highest at $152 per share, or was issued in exchange for the convertible bonds at about $134 per share. None of the stock has been issued as a dividend, nor have any cash dividends been declared to meet payments for stock issues.

At the close of 1909 the premiums thus received over the par of the outstanding share capital amounted to over $14,000,000.

The original owners and promoters of the telephone were first of all business promoters. Their idea was to develop the business on broad lines. Whatever reward they expected or received was the legitimate reward following a legitimate development of a substantial and beneficial business.

*From the A. T. & T. Company's Annual Report for 1909.

To develop the business it was first necessary to develop the "art." It was unique, nothing like it existed; the whole art of the practical application of electricity was new and undeveloped.

To develop the business to the best advantage all the best in the way of instrumentalities, apparatus and methods must be controlled. Apparatus and methods at the start were crude, but new instrumentalities and new methods were suggested from daily association, practice and study.

It was necessary to develop these, improve and reduce the useful to practice, and eliminate the worthless. For this purpose a staff of technical, electrical and mechanical operating experts must be gathered together and educated. To educate and assist these, to enable them to do intelligent work, avoid repetition and duplication, all that had gone before and all that was being done here and elsewhere must be known. For this purpose a bureau of research and information was formed. Patent and legal experts must be employed and educated to secure the advantage of this work and study, as well as to furnish protection in the use of the patents.

A highly developed manufacturing organization under proper supervision and control was required to reduce to practical use these ideas and inventions, as well as to secure the standardization and uniformity of instruments and apparatus.

To ascertain which were the best of the methods being evolved in field practice, to educate the others in the use of them, to assist generally in the development, and to bring about standardization of operating practice and methods, a staff of traveling experts, observers and teachers was placed in the field.

The preliminary work was certainly difficult enough. Add to that the necessity of educating a doubting, hesitating public who looked on the invention as little better than a toy, and some idea of the task can be formed.

In the promotion and exploitation of the business two methods were possible.

One company covering the whole country would require a large executive and administrative staff in the field, and a large capital which, at the time, it was impossible to secure. Under this method, state organizations would also have been necessary to hold franchises.

The other way was to enlist a large number of individual workers, each with some capital, large faith and expectation, with great capacity for work, who would cover the field and develop the business.

To insure a common policy and central control, all licenses were issued for small units of territory under restricted terms, confining the business entirely within each territory. The parent company owned and furnished the telephones, had all reversionary interests or rights in the territory, and the right to connect the units with each other for the purpose of forming a universal intercommunicating telephone system. For this purpose the long-distance lines and other toll lines were built. Under these temporary licenses certain rentals, so-called, or royalties, were paid to the parent company for the use of the telephones and other inventions owned, and also as compensation for all the many other services rendered, as described above. When these licenses were made permanent and included all future as well as all existing inventions, and the right to the business within the units of territory, the parent company retained an interest in the business which was represented by a stock interest in each company.

These licenses called for a continued certain percentage of the stock of the company, but this right was soon waived by the parent company.

Through purchases to defeat the attempts of hostile interests to get possession of some of the associated companies, through the necessity of financing the companies for the purpose of keeping up with the demands for development, and through the purchase of its pro-rata of new issues, the American Telephone and Telegraph Company acquired its large holdings.

The book valuation of the American Telephone and Telegraph Company's interest in the share capital of the associated operating companies December 31, 1909, was nearly $306,000,000; of this only $16,000,000 was received through contract or for licenses. The balance, $290,000,000, was obtained under precisely the same conditions that shares have been received by the other shareholders.

While the settlement with the Western Union Telegraph Company in 1879 removed from the field the most formidable and powerful competitor, it must not be concluded that the American Bell Telephone Company had the field to itself. The Bell system did not then, nor did it in any year or any time since the great value of the telephone to the world was established, have a monopoly of the business or anything approaching it.

Patents and inventions were necessary for defense, but were no protection against imitators.

There was a continued running fight in the courts and in the field. The fact that the Bell won its cases in the courts availed it nothing except that it was credited with a monopoly which did not exist.

The only time that the Bell Telephone was without a competitor was at the Centennial Exhibition of 1876.

First American Loaded Submarine Cable

The first submarine cable using the Pupin system of loading that has ever been installed in this country has been installed across Chesapeake Bay to serve Telephone subscribers in Delaware and on the eastern shores of Maryland and Virginia in their service with Baltimore and Maryland.

This cable was developed by a corps of expert engineers in Chicago, New York, and Philadelphia, and Baltimore—a corps of fifteen or twenty men who spent two or three months working on its development. The result is that across Chesapeake Bay there is now a submarine cable which makes telephone conversation from Baltimore to Cape Charles or other peninsular points equivalent to a conversation over a land line fifty miles shorter than by way of the former route.

It is interesting to add here that not only has this cable been laid, but additional wires have been run to the terminals of this cable from points in the southern part of the Eastern Shore peninsula and from Baltimore and Annapolis to the other end.

Cumberland Company Fined by State

Judge Blount in the Chancery Court at Water Valley, Miss., June 28, imposed a fine of $175,000 for violation of the state antitrust law upon the Cumberland Telephone & Telegraph Company. The company was charged with entering into a contract with the Oxford Telephone Company in Marshall county for the purpose of shutting off competition.

The Manufacture of Telephone Jacks

By E. A. Hawkins

IN a large manual switchboard the cost of the answering and multiple jacks is about 15 per cent of that of the total inside telephone plant. Therefore the life of these jacks is a big factor in producing a low annual charge on the total equipment.

Of all the parts that are subject to wear, the jacks are the most difficult and the most expensive to replace. It is therefore evident that the jacks should have a long life.

When a plug is repeatedly inserted in a jack there is necessarily some wear on the parts coming in contact with one another. If the metals of these parts were of the same degree of hardness the wear might be equal on the two parts. If the parts of one were harder than the parts of the other, the greater wear would come on the softer part. Since there are many more jacks than plugs, and since the plugs are readily renewed without interrupting the service, it is evident that the parts of the jack should be harder, so as to have most of the wear come on the plugs.

Group of Operators Testing Jacks.

Since all telephone conversation must pass through at least two jacks, it is evident that a jack, even when considerably worn, must make a secure contact with the plug in order to render good telephone service. Another important requirement of a good jack is to hold an inserted plug firmly in position, for otherwise the connection between the plug and the jack might become broken by the operator in working among the cords. This feature is provided for by using jack springs of the proper strength and shape, and by having these springs properly spaced in relation to the contour of the plug. The proof of a good jack in this respect is in that it requires a greater amount of force to withdraw the plug from the jack than to insert the plug in the jack.

A telephone jack of a type that has fulfilled the most exacting requirements of the telephone engineers is shown in Fig. 1. The illustration shows the No. 92 jack manufactured by the Western Electric Company. There are said to be over twenty-eight million of this type in use in the United States alone. This jack can be found in almost every civilized country in the world where a telephone is in use. It has been adopted for use by many foreign governments, including the British, German, French, Italian, Belgian, Spanish, Swiss and Servian.

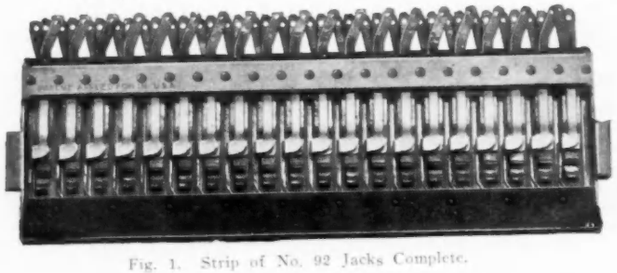


Fig. 1. Strip of No. 92 Jacks Complete.

In the construction of a single strip of twenty of these jacks there are about 850 operations, which employ 185 piece parts.

The parts of a jack by which electrical connections are made with a plug are the tip, ring and sleeve. These parts are made of German silver. All of the electrical contact parts are separated from one another by a special grade of hard rubber, which permits of a breakdown insulation test of 500 volts alternating current between all metal parts. All of the piece parts are assembled together and mounted on a punched brass frame, thus producing a jack which is practically indestructible.

One of the distinctive features which adds to the length of life of this jack is a seamless sleeve spring. In the manufacture of this spring the first operation is simply a flat piece of German silver blanked to shape. The different stages through which this must go before arriving at the finished article include several operations in forming, drawing, annealing, cutting, reaming and cleaning. The spring is finally tinned and lacquered, and is then ready for assembling.

It is a well-known fact that sheet German silver will vary in thickness an almost imperceptible amount at different parts of the sheet, with the result that when springs are punched from this sheet, those coming from different parts likewise differ in thickness an almost imperceptible amount. Therefore, after the tip and ring springs are blanked and formed in the regular punch press operations, they are carefully reformed by a hand fixture, thus insuring correct shape. This overcomes the slight variation in thickness of the metal, and also the slight variation in the wear of the punches and dies. After these springs are thus bent to the proper shape they are placed in another hand fixture, where they are tensioned so that each spring will have a definite number of ounces of spring pressure.

The frame on which the springs and hard rubber face strips are mounted is shown in Fig. 2. It consists of a brass strip, blanked, formed and lacquered. Fig.

3 is a view of the tip and ring springs assembled together with their rubber insulators on a common mounting strip. All of these parts above mentioned are finally assembled together to make a complete jack, as shown in Fig. 1.

Each of the parts, as well as the final assembled jacks, are given a very careful inspection. All of these operations produce jacks that have a minimum amount of trouble and a maximum length of life.

INSPECTION AND TESTING.

Inspection may be defined as a careful and critical investigation. Testing may be defined as an act of

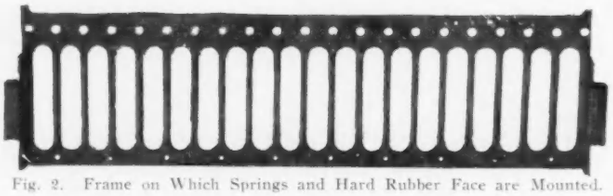


Fig. 2. Frame on Which Springs and Hard Rubber Face are Mounted.

proving whether an article complies with a predetermined specification to determine whether or not the material inspected is satisfactory.

The raw material inspection includes the scrutiny of all material purchased for manufacturing purposes. When the material is received it is delivered to the raw material inspection room. Then it is given a detail or general inspection, depending upon the method of manufacture before delivery to the factory, the manner in which it is used in the factory or the reliability of the manufacturer. For example, the brass and German silver comes in sheets and is inspected for size and temper. Whether it receives a detailed or general inspection depends on conditions outlined above. As a rule this material requires very little inspection, as the manufacturing company gives it such close inspection that a further detailed inspection is not required. A practical test is also given this material by taking a sample and making up a strip of jacks to determine the quality and hardness.

The commercial screws used in the manufacture of the jack are checked for outside diameter, maximum size and the pitch and root diameters. Since the adopting of the American Society of Mechanical Engineers' standard screw gauge by all American screw manufacturers, only a small number of screws are given a detail inspection.

In a general way, the inspection of the piece parts of jacks is laid out to parallel the manufacturing operations. The fundamental principle of the process inspection is that after each manufacturing operation a sufficient inspection should be given to determine if the work has been properly done, and to allow only good material to pass on for further operations.

There are about forty-five general inspections and about 121 detail inspections made by the process inspectors in the manufacturing operations of a strip of twenty of these jacks.

The general inspections cover generalities such as thickness of metal and general appearance. Only a small percentage of the total are given this general inspection, depending on the way the work is being done.

The detail inspection, for example of the sleeve part, includes the length over all, length of shell, inside and outside diameter of shell, etc. The inspectors are provided with special gauges for inspecting these various pieces.

The inspection process includes the final inspecting and testing of the manufactured jacks when they are completely assembled. This is done before the material is delivered by the shop for shipment or storage.

When the jacks come from the assembling department they are first measured for "over all" dimensions and "shoulder" dimensions. This is done by placing each strip in a frame somewhat similar to that shown in Fig. 4, and by means of a push button and a scale, which are a part of this fixture, they are measured automatically and quickly.

The thickness of the jack and the distance from the shoulder of the sleeve spring to the rubber face strip are then measured with a hand gauge. The inside diameter of the sleeve shell of each jack is then measured with two plugs. The difference between these plugs is only 0.0015 of an inch, and yet one of these plugs must enter the shell and the other must not.

The jack is then given a general inspection for the following points: That face of strip is properly polished, that edges of rubber face strip are not chipped, that group spottings are not defective, that the beveling of rubber face strip is uniform, that the sleeve shells are not defective, that shell clamping lug is well set in the groove, that the frame pins are neither low nor high, that the frames are not loose and flush with face strip, that the ring springs are lined up properly and are thoroughly tightened, and that the ends of the springs are thoroughly tinned and cleaned.

The jacks are then given a number of tests by first placing them in a testing fixture, shown in Fig. 4. This testing fixture is provided with two six-volt incandescent lamps, each one protected with a large lens located directly in front of the testing operator. A key having two sets of springs operated by one lever is also provided on the left side of the testing fixture. To one set of springs is connected six volts direct current and to the other set is connected 500 volts alternating current.

By locking the jack strip in the testing fixture by a hinged lever, all of the sixty springs of the jack

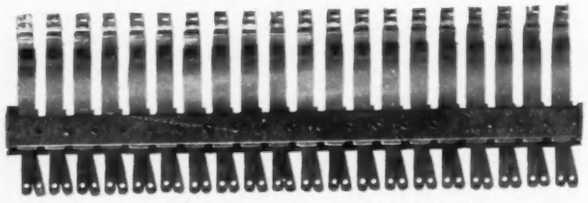


Fig. 3. Tip and Ring Springs, with Insulators, on Mounting Strip.

strip simultaneously make contact with corresponding springs of the fixture.

The insulation between the springs is first tested by pressing forward the key lever mentioned above, connecting the six volt direct current battery. If a cross exists between the springs the left lamp will be lighted and the strip of jacks is rejected. If the lamp is not lighted the testing operator presses the key lever in the opposite direction, connecting the 500 volts alternating current. If a cross exists between the springs a loud ringing bell gives the signal to the operator. This also causes the jack strip to be rejected. The latter test is given to detect poorly in-

sulated springs that are not detected with the six volt lamp test.

With the jack strip still locked in the above mentioned fixture, the position of the springs is then tested with a test plug. When this plug is inserted in any jack of the strip and the tip and ring springs make contact, both lamps are lighted. If the tip spring makes contact alone the left lamp is lighted. If the ring spring makes contact alone neither lamp is lighted.

Both the diameters of the ring and tip conductors of this test plug are much smaller than those of standard plug "A" (Fig. 5). The contour of the test plug represents a maximum worn plug. If this makes perfect contact with each jack, a long life of the regular switchboard plugs is assured.

The position of the springs is further tested with a test plug shown at "B" in Fig. 5. When this test plug is inserted in any jack, the tip and ring springs must make contact on the middle ring of the three insulated rings there shown. The distance between the contact points of these springs must be very accurate as a variance of only 0.01 of an inch is allowed. If the springs are not in their correct positions, the same code of lamp signals is received by the operator as when testing with the test plug first mentioned.

With still another test plug, the tip spring must not touch the ring spring when it is inserted in any jack. If such a condition exists the right hand lamp is lighted. The tip of this test plug is much larger and is of a different contour than that of the tip of the standard plug.

Since the tip and ring diameters of this plug are greater, it will cause the tip and ring springs of the jack that is under test to be raised higher than under normal conditions when the standard plug is used. If under this abnormal test the springs of the jack do not come in contact with one another, it is an assurance of their proper operation in a switchboard even under abnormal conditions. If it were not for this factor of safety, it might be possible with a worn

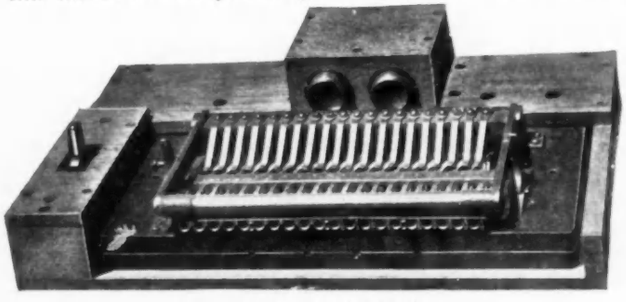


Fig. 4. Fixture for Testing Jacks.

plug for the operator to subject the plug to an undue amount of strain that would tend to raise the jack springs an unusual amount and thus cause a "cross" between the springs.

A certain number of jacks in each lot are given special tests, such as tension of springs, in which the spring is weighed with a special spring balance for determining the proper contact pressure of the springs upon the plug.

The jacks are then placed in another testing fixture, similar to Fig. 4. This fixture is provided with such apparatus as will test the insulation between all metal parts. This is tested with 500 volts alternating current. When a defect is found a bell rings automatically, notifying the operator that the jack is not perfect.

All tools and gauges are given a detailed inspection at stated periods. Those having very fine limits are measured each day. A card index record is kept for each tool and gauge and its exact condition at the last inspection can be determined at any time.

An investigation or check inspection is made on a portion of all apparatus. This is done for the purpose of checking the accuracy of the first inspectors, their gauges and their methods.

A certain per cent of raw material and finished

Fig. 5. *A*—Standard Plug. *B*—Testing Plug.

apparatus are given a detailed inspection by the engineering inspection department, in order to determine whether the manufacturing department has properly interpreted the manufacturing, testing and inspection specifications.

After reading the descriptions of these tests, one must necessarily become impressed with the accuracy of it. It should be noted that wherever possible the chance for personal errors is entirely eliminated. In some tests signal lamps are lighted to denote a perfect jack and in other tests signal bells are rung to denote an imperfect jack, etc. Furthermore, on all tests where the personal element can not be eliminated, checking and rechecking tests are made by other inspectors in order to reduce the chance of personal error to a minimum.

The wonderful progress in accurate workmanship that has been made in recent years is quite marvelous. It was only a few years ago that we were inclined to believe that it was a difficult matter to maintain a commercial accuracy within an hundredth of an inch, yet on much of the apparatus that is made today, limits as fine as 0.0015 of an inch are maintained.

Wisconsin Association Holds First Meeting

During the past few years the telephone companies of Wisconsin have suffered somewhat from the lack of co-operation among themselves. Having been brought to a realization of this fact, a meeting of some of these companies was held in the city of Milwaukee May 27 and 28, looking toward the formation of a permanent organization for the promotion of such co-operation, and the following committee was appointed to perfect arrangements: J. A. Pratt, Menominee Falls; C. Engsbury, Lake Mills; R. M. Richmond, Evansville; E. A. Miller, Hixton; J. C. Marsh, Marshfield; E. G. Stolte, Reedsburg; H. A. Price, Markeson; A. J. Perkins, Medford; H. Teasdale, Sparta; A. A. Paulsen, Chilton; E. J. Lins, Eagle; Fred Runkle, Portage; P. J. Weirich, Monroe; E. V. Corey, Phillips; Mr. Cleary, Antigo; Mr. Bowler, Sheboygan; John Gaveny, Arcadia.

This committee was chosen with a view to representing as nearly as possible the different sections of

the state. The committee at once began making arrangements for a meeting to be held at Madison, July 13 and 14, and went to considerable expense in preparing a program which would be both interesting and instructive. Notices were sent out to the different companies urging their attendance, in view of the fact that the official year of all telephone companies was nearing a close, at which time reports to the Railroad Commission would have to be rendered, also for the information which would be gained from the discussion on the subject of accounting.

The committee argued that as there are approximately 600 telephone companies in the state of Wisconsin, there was no reason why an association could not be formed from which would be derived more profit and benefit for the small amount which it would be necessary to invest to maintain such an association, than from any other investment which a telephone company could make. It also held forth the idea that there is no other business which needs an association as badly for the reason that each company is more or less dependent upon its neighboring companies, and in place of being the last to form such an association they should be among the first.

Accordingly in response to this urgent appeal—not only to attend the meeting itself, but to bring along neighboring companies, representatives of some eighty telephone companies attended the meeting.

John A. Pratt, Menominee Falls, was chosen president and P. J. Weirich, secretary. The question of a constitution for the organization was the first to be considered, and one was adopted.

A portion of the platform agreed upon provides that membership fees shall be based upon the number of telephones installed and according to the following scale: Two hundred telephones or less, $5; five hundred or less, $10; one thousand or less, $15; one thousand five hundred or less, $20; more than one thousand five hundred, $25.

A paper was read by W. F. Sloane of the Railroad Commission on "A Proposed Wisconsin Standard Telephone Service," setting forth what the commission proposes to adopt as a standard of telephone service, which will affect all telephone companies in the state, as the value of their service rendered will be measured by this standard in the future.

As had been previously arranged, the subject of "Difficulties of Maintenance" was discussed by J. Leyda, manager of the Evansville Telephone Company, a practical telephone man, and one who has been exceptionally successful in eliminating many of the ordinary difficulties of maintenance.

W. J. Hagenah of the Railroad Commission, addressed the meeting on "Telephone Accounting," setting forth not only what the commission will expect in this year's report, but how to arrive at these amounts. There were several detailed systems offered to the telephone companies, as the preparation of a system of accounting which would meet the needs of classes "B," "C" and "D" companies has been a part of the work of the committee which has been appointed to arrange for the convention, and these were open for inspection and explanation.

The question of what constitutes reasonable rates was also discussed.

Among those present were the following: George H. Hanks, Westfield; F. H. Runkle, Portage; L. A. Herrick, Freeport, Ill.; S. L. Van Almar, Waupaca; William Dauffenback, Reeseville; W. J. Clark, Rudolph; Charles Wath, Black Earth; James E. Hill, Cambridge; F. W. Coll, Ashland; J. A. Jackson, Rudolph; W. L. Smith, Neillsville; A. L. Leyda, Evansville; P. C. Brown, Edgerton; E. A. Miller, Hixton; H. G. Clark, Cottage Grove; T. S. Chrittendan, Ripon; Edwin Haskins; O. G. Loomis, Mauston; Jacob Christ, Boscobel; J. W. Schmidt, Prairie du Sac; J. A. Pratt, Menominee Falls; J. A. Fountaine, Cedar Grove; Franklin Johnson, Baraboo; G. Radke, Caroline; August Dorn, Hilbert; James Edwards, Elroy; G. C. Clark, Augusta; O. F. Gunther, Campbellsport; H. C. Winter, Madison; G. H. Dunn, Oxford; Neil Brown, Briggsville; H. R. Jamieson Poynette; F. S. Veeder, Mauston; J. N. Dahlen, Mt. Horeb; John Dollinger, Hixton; A. Plinker, New Lisbon; George Beyer, Westby; W. G. Lowton Viroqua; C. L. Christianson, Bloomer; A. Bebersdorf, Shawano; John H. Math, Verona; N. M. Berg, Auburndale; J. W. Holleran, Knapp; S. Meyer, Huberton; P. J. Weirich, Monroe; W. H. H. Cash, New Lisbon; J. C. Marsh, Marshfield; Conrad Engsberg, Lake Mills; W. T. Sparks, Loda; E. A. Kneen, Bangor; F. M. Perkins, Medford; F. W. Schinner, Eagle; J. Wilkpaugh, Brooklyn.

Chairman Pratt stated that the understanding that the meeting was intended solely for the independent companies was erroneous, that the plan was to organize broadly in the interest of general betterment of the telephone service of the state.

Telephone Patent Decree

By a decree entered in the federal court in a case in which the Western Electric Company had alleged infringment of patent against the Sterling Electric Company, it is held that the complainant is the sole owner of the patent on an apparatus for telephone switchboards granted to the complainant October 22, 1895, as assignee of Charles E. Scribner, and also is the sole owner of a patent for supervisory signals for telephone switchboards granted April 17, 1906, to the complainant as assignee of Frank R. McBerty. It further is decreed that the defendant infringed on these two patents; that the complainant should recover from the defendant the costs of the suit, and the sum of $1 as nominal damages, and that the defendant be perpetually enjoined from making or selling, without license of the complainant, and telephone apparatus that infringes on these two patents.

Telephone Operators in the Philippines

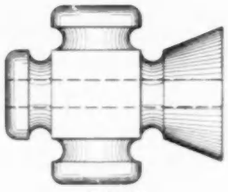
According to reports brought back from the Philippines, the position of telephone operator in our newly acquired possessions is quite important and one which is much sought after. This is not only due to the limited field for female labor, but to the added fact that the position is considered one of honor and carries with it considerable social prestige. For this reason these positions are filled from the best families of the islands. Each operator has her servant who ac- Tagalog, the aboriginal language, and some are able to speak Chinese and Japanese.
companies her to the exchange, acting as her chaperone, and also serves her in other ways. She must be able to speak and understand English, Spanish and

Recent Telephone Patents

By David S. Hulfish

954,596. Insulator. A T-shape insulator knob, having tying grooves upon all its branches. Its particular advantage lies in turning the direction of a pair of wires. Albert L. Stadermann, Terre Haute, Indiana.

954,701. Telephone Set. In a microtelephone set, two receivers are provided, and the switch is operated when the receivers are spread for the ears of the user. James E. Rogers, Danbury, Conn., assignor to Frank H. Lee, of same place.



954,596.

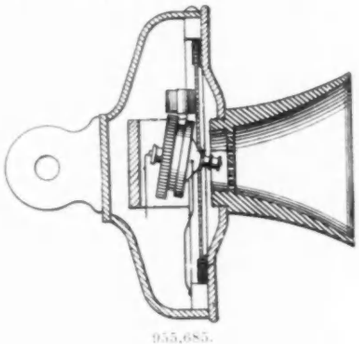
954,734. Composite System. A telegraph instrument is provided which sends current impulses of rounded wave form, a form least able to disturb the telephone circuits of the composite line. George E. Hines, New York, N. Y., assignor of one-half to William T. Daley, Brooklyn, N. Y.

954,829. Microtelephone. The claims cover specific mechanical details of the hinge. Victorien Tardieu, Arles, France.

954,909. Attachment. In combination with the transmitter and hook lever, shutters carrying sterilizing agents are placed automatically over the transmitter when the receiver is hung upon the hook. Florence M. Allen, Chicago, Illinois.

954,931. Receiver. The sound-producing diaphragm is attached to the longer end of a rigid lever, the lever being pivoted upon one pole of a bi-polar receiver magnet and its free end swinging as an armature toward the other pole. Adjustable retractile means are shown. The object is a very loud speaking receiver. John J. Comer, Santa Monica, Calif., assignor to George R. Webb, Baltimore, Md.

955,056. Fire Alarm. Upon a telephone line, a buzzer at the substation sends high-frequency currents to the central office in case of a fire alarm, a resonant relay at the central office receiving the currents. A fire signal may be transmited over the telephone line whether the line is idle or busy. William W. Dean, Elyria, Ohio, assignor to Consolidated Fire Alarm Company, New York, N. Y.



955,685.

955,134. Key. In a strip of keys, the last one depressed remains down and unlocks the one previously depressed. A key suitable for "Automanual" keyboards. John F. Cadell, Baltimore, Md., assignor to North Electric Company, Cleveland, Ohio.

955,190. Attachment. When the receiver is removed from the hook, the number of the telephone is struck in code upon a system of gongs. By this means, the station lifting the receiver upon a busy party line may be identified. John W. Nilsson, Balfour, N. D.

955,253. Selective System. In a harmonic signaling system, sensitive harmonic relays are placed at the stations, and the actuated relay switches the ringer into circuit with the line. Hiram D. Currier, Bloomfield, N. J., assignor to Western Electric Company, Chicago, Ill.

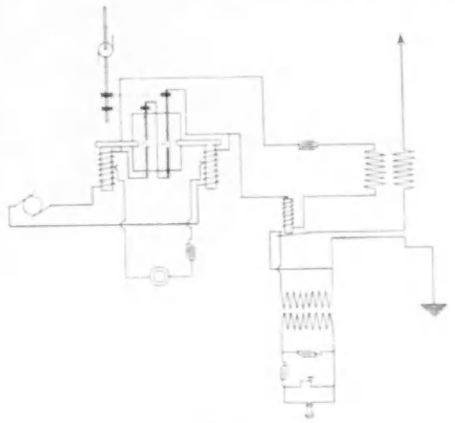
955,302. Bell. A harmonic ringer with adjustable armature support. The claims refer to the adjustment means. Herman L. Wuerfel, Maywood, Ill., assignor to Western Electric Company, of Chicago, Ill.

955,335. Magneto System. Signaling to stations is done over one wire and earth, and signaling the central office and talking is over the metallic pair. Henry F. Joeckel, Clayton, Illinois.

955,633. Ringing System. A system of central office circuits whereby the ringing generators are connected to the cord circuits separately and in successive periods only. Mirritt S. Connor, Oakdene, Hale, England, assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.

955,685. Transmitter. In a transmitter of the usual granular carbon type, the carbon cell is placed in an inclined position. George N. Quinby, Jr., North Providence, R. I.

955,716. Transmitter. The transmitter contains a differential resistance button, comprising three electrodes, the middle one moving between the outer two. Pietro Stragiotti, Hurley, Wis.



955,852.

955,806. Protector. A unit designed for substations, having a pair of heat coils, in which either heat coil will open both sides of the telephone bridge and connect and ground both of the line wires. William Kaisling, Chicago, Ill., assignor to Frank B. Cook, of same place.

955,921. Receiver. In a receiver of the watchcase type, the magnet is a complete ring with a central lug. Harve R. Stuart and Edwin O. Kizer, Wheeling, W. Va.

955,923. Microtelephone. The receiver and transmitter are connected by a pliable member. Wilbur H. Thompson, Wheeling, W. Va.

956,171. Transmitter. The novelty in the transmitter is found in the mouthpiece, which is of comparatively large size and has a number of sound-collecting funnels radiating in different directions from the diaphragm of the transmitter. Thomas C. Rafferty, Philadelphia, Penn.

956,228. Long distance Telephone Apparatus. The substance of this patent is very clearly expressed in the first of its claims, which reads as follows: "A telephone system having the transmitter and receiver provided with hollow bodies or chambers arranged close to each other and harmonically proportioned one to the other." Victorien Tardieu, Arles, France.

956,251. Signaling System. In a local battery system, the hand generator is dispensed with by signaling inductively from the local battery through the induction coil to trip the

central office drop. To secure the required step-up transformation in the induction coil, it is provided with a number of secondaries and a signaling key connects the secondaries in series for signaling and in multiple for talking. David H. Wilson, Chicago, Ill., assignor to Robert Bines, of same place.

956,255. Selective Signaling System. Each station of the party line is provided with a telephone ringer and with a polarized relay. With two batteries or direct-current sources at the central office in addition to the usual ringing generator of a single frequency, a selection among eight stations upon a party line is secured. Condenser insulation of the line conductors is not shown in the drawings. Max W. Zabel, Chicago, Ill., assignor of parts to J. G. Ihmsen, Chicago, Ill., and Oscar M. Leich, Genoa, Ill.

956,377—Hookswitch. A new design of the detachable hook type. Oscar M. Leich and Niels Pedersen, Genoa, Ill., assignors to Cracraft-Leich Electric Company, of same place.

956,484. Register. A register associated with the cord pair has an index wheel revolving to the number of the connected line and operating to impress the number of the line upon a record tape when the connection is complete. Edward E. Clement, Washington, D. C.

956,754. Coin Collector. An electrical device with a single slot for several sizes of coins, and size-distinguishing devices for the coins within the collector. Robert L. Bowman, Knoxville, Tenn.

956,782. Selective Signaling System. A step-by-step device is located at the substation, and a polarized relay bridged across the line circuit enables the central office operator to control it. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, of same place.

956,953. Attachment. A transmitter mouthpiece has a deep groove near its base to hold antiseptic or absorbent material. William M. English and Harry M. Lichtenstein, San Francisco, Cal.

957,067. Attachment. A sign plate is displayed while the receiver is off the hook. Joseph Kuhn, Pittsburg, Pa.

957,300. Cable clip. A metal clip, the ends of which independently surround the messenger wire and lock upon themselves. Thomas J. Baugh, Hopkinsville, Ky.

957,403. Receiver. A permanent magnet and an electro-magnet are mounted with the case, the armature of the electro-magnet being centrally pivoted with one end attached to the receiver diaphragm. Means are provided also for equalizing the strain of the diaphragm against the armature. Nathaniel Baldwin, Heber, Utah.

957,404. Attachment. A device adapted to receive upon one side a telephone mouthpiece of small diameter and upon the other side a mouthpiece of larger diameter whereby any mouthpiece may be fitted to any telephone. Anna Bebout, St. Louis, Mo.

957,489-90-91. Automatic line. A system comprising a number of telephone instruments, a selecting instrument at each telephone, a main telephone circuit connected through all the selecting instruments and arranged to be closed through the local telephone circuits of any two telephones, and an emergency circuit forming a part of the main telephone circuit. Charles F. Bradburn, Delmer, Ontario, Canada.

957,506. Cable. A cable made up of paired wires, each pair twisted with a variable lay and the several pairs being transposed with reference to each other at intervals. Roderic F. Hall, East Orange, N. J., assignor to Western Electric Company, Chicago, Ill.

957,852. Wireless telephony. A circuit using the singing arc is employed, but the novelty of the patent resides in the automatic means for transferring the antennae from the receiver to the transmitter when the transmitter is active and from the transmitter to the receiver when the transmitter is not active. Victor H. Laughter, Detroit, Mich.

957,869. Intercommunicating system. The object is to enable the receiving station to hold the central office signals set upon a trunk until the desired station has answered the call, and thereafter to leave the central office signals under control of the called station. Elmer R. Corwin, Chicago, Ill., assignor to Corwin Telephone Manufacturing Company, of same place.

957,909. Automatic system. Automatic means is provided to enable a calling line to become connected with a desired called line for conversation, and further means is provided whereby still a third line may be selected and connected with to form a tri-partite connection for conversation. Alton E. Stevens, Fall River, Mass., assignor of part to Samuel H. Couch, Wollaston, Mass.

Items of Legal Interest

By Ralph M. Loring

INDEMNITY INSURANCE.

A policy indemnified a telephone company against damages to any person not employed by the assured from the operation of the telephone plant. It was stipulated that the policy should not cover loss from liability for injuries suffered otherwise than during "the immediate doing of the work of construction." The telephone company while putting up a line trimmed a tree on the land of a third person. The owner refused to permit the trimming of the remaining trees unless the tree already cut was trimmed as he desired. While the employes of the telephone company were trimming the tree a person not employed by the company was accidentally killed, and the telephone company was compelled to pay for his death. *Held*, that the accident happened during "the immediate doing of the work of construction," and the indemnity company was liable. *Camden & Atlantic Telephone Co. v. United States Casualty Co. Supreme Court of Pennsylvania. 75 Atlantic* 1077.

INJURY TO CONDUITS.

A telephone company, having conduits under the streets which are damaged by the driving of a stake by a house mover, is under no duty to inform the mover of the location of its underground wires, though it had knowledge of the moving, went over the route which was to be taken, and contracted to remove all overhead wires which were in the way, since modern streets are so underlaid with pipes and conduits of various kinds necessary to the welfare of the citizens that it was more the duty of the mover to inform himself, as he could have done by consulting maps in the city engineer's office, of the exact location of all underground conduits of the company, and the fact that the conduits were between the curb and the sidewalk would make no difference. *Frontier Telephone Co. v. Hepp. Supreme Court of New York.* 121 *N. Y. Supp.* 460.

POWER TO GRANT RIGHTS TO TELEPHONE COMPANY.

Under the law of Kentucky (Acts 1881-82, p 817, c. 461), which holds that the use of a street by a telephone company is for a public and not a private purpose, general power expressly given to a city by a special charter to "regulate" the streets, alleys, etc., imports power to control their use, the word "regulate" being a word of wider import than "control," and authorizes the city to grant the right to a telephone company to erect and maintain its poles in the streets, and such a grant in the nature of a contract, made before the adoption of the state Constitution of 1891, under which the company proceeded to build

and operate its lines and exchange at a large expense, is not affected by such Constitution under the proviso of section 163. *City of Owensboro v. Cumberland Telephone & Telegraph Co. U. S. Circuit Court of Appeals.* 174 *Federal* 739.

DEFECTIVE APPLIANCES.

That a lineman of a telephone company using the poles of a power company, understood that the wires of the power company were inspected by the employes of the power company and not by the employes of the telephone company, did not charge him with knowledge of defects in the power wires which a reasonable inspection would disclose, since he could assume that the telephone company was mindful of its obligations to its employes and had knowledge of the wires which satisfied it that an inspection by its employes was unnecessary. *Miner v. Franklin County Telephone Co. Supreme Court of Vermont.* 75 *Atlantic*, 653.

SAFE PLACE TO WORK.

A lineman employed by a telephone company using the poles of a power company need not make an inquiry as to the arrangement between the two companies, and he may assume, as against his employer, that he was entitled to use a pole of the power company where he was brought there to work and no other provision was made for reaching the place of the work than such pole, though the telephone company had removed its wires from such pole. *Miner v. Franklin County Telephone Co. Supreme Court of Vermont.* 75 *Atlantic* 653.

STRIKE INJUNCTION.

Where, after a strike injunction had been made permanent, the bill was amended, and new parties made defendants, and injunctions sought as against them, on the theory that they had become parties to a conspiracy to injure complainant's business, but, while they answered, admitting their sympathy with defendants and their desire to aid them, there was no proof of their connection with the alleged conspiracy in an unlawful way, the injunction as to them should have been dissolved. *Corcoran v. National Telephone Company of West Virginia. U. S. Circuit Court of Appeals.* 175 *Federal* 761.

WRONGFUL REMOVAL OF TELEPHONE.

Evidence offered for the purpose of showing that the plaintiff, prior to bringing the action, offered to refrain therefrom if an explanation for the unauthorized removal of his telephone satisfactory to him was made (such testimony being offered to support a claim for punitive damages), was properly repelled. The question properly for investigation was the nature and effect of the defendant's act, which was alleged to be tortious, and not the conduct of the plaintiff after the tort was complete. *Jenkins v. Southern Bell Telephone & Telegraph Co. Court of Appeals of Georgia.* 67 *Southeastern* 124.

INJURY BY HOUSE MOVER.

A telephone company placing, by virtue of a city franchise, conduits to carry its wires under the street between the curb and the sidewalk, has a property right therein, and where a house mover, under permit from the city to move a house, drives a stake into the ground, whereby the wires in the conduit are damaged, it is an unlawful trespass for which the mover is liable, irrrespective of negligence, since the right of occupation of the telephone company was prior, permanent, and a semi-public right, while the right of the mover was temporary and a purely private right. *Frontier Telephone Co. v. Hepp. Supreme Court of New York.* 121 *N. Y. Supp.* 460.

INJUNCTION AGAINST INTERFERENCE.

In an action to restrain defendants from interfering with plaintiff telephone company's maintenance of a stub pole and anchor in the street in front of defendants' premises and for damages, where plaintiff alleged the necessity for the pole and anchor, and defendants' refusal to allow its erection and the evidence sustained the allegations of the complaint, the judgment restraining defendants from interfering with the pole only should have been modified so as to include the anchor also. *New Long Distance Telephone Co. v. White. Appellate Court of Indiana.* 90 *Northeastern* 1038.

INJURY TO LINEMEN.

Where the foreman of a telephone company inspected an old pole to be dismantled, and compelled a lineman to rely thereon and to climb thereon without inspecting it for himself, the fact that the pole fell under the weight of the lineman, injuring him, was prima facie evidence of actionable negligence in the inspection. *Miller v. Missouri & Kansas Telephone Co. Kansas City Court of Appeals, Missouri.* 126 *Southwestern* 187.

GUARDING AGAINST LIGHTNING.

In an action against a telephone company for injuries by lightning while using a telephone, evidence *held* to show that the injury was received while plaintiff was using the telephone in the ordinary way, and that no severe electrical storm was in progress, and that the failure on the part of defendant to attach a ground wire to its lightning arrester, to the telephone, was negligence proximately causing the injury. *Southwestern Telegraph & Telephone Co. v. Abeles. Supreme Court of Arkansas.* 126 *Southwestern* 724.

CONTRIBUTORY NEGLIGENCE.

Though it was not a lineman's duty to examine the guy wire of a telephone pole to see if it was live, if he knew that the guy wire was not safe, he was bound to exercise reasonable care in view of the danger in climbing the pole in the discharge of his duties, and his failure to do so would be negligence precluding recovery for injuries from contact with the guy wire. *Citizens' Telephone Co. of Kentucky v. Wakefield. Court of Appeals of Kentucky.* 126 *Southwestern* 127.

FAILURE TO WARN LINEMAN.

If a telephone company knew, or by ordinary care could have known, that guy wires on a telephone pole were charged with electricity in time to have warned a servant, whose duty required him to climb the pole, its failure to warn him was negligence. *Citizens' Telephone Co. of Kentucky v. Wakefield. Court of Appeals of Kentucky.* 126 *Southwestern* 127.

JURISDICTION OF FEDERAL COURTS.

Under the federal Constitution, a municipal corporation, although having power to regulate the rates to be chargd by a telephone company, may not reduce such rates below a rate which will pay operating expenses, maintain the plant, and pay a fair return on the capital actually invested, and a bill to restrain the enforcement of a rate alleged to be confiscatory presents a federal question and is within the jurisdiction of a federal court. *City of Owensboro v. Cumberland Telephone & Telegraph Co. U. S. Circuit Court of Appeals.* 174 *Federal* 739.

LIGHTNING CONDUCTED BY TELEPHONE WIRES.

To prevent lightning being conducted into a house by telephone wires, use of which has been discontinued, it is the duty of the telephone company to use not only the best precautions known to it or its agents, but to take such reasonable precaution as a man of ordinary prudence would do to select and use the best methods known to science to prevent injuries, and since it operates a dangerous agency, it cannot escape liability for resulting injury on the plea alone that instrumentalities used to protect its patrons were as good as known to it. *Texas Telegraph & Telephone Co. v. Scott. Court of Civil Appeals of Texas.* 127 *Southwestern* 587.

TELEPHONE PAY STATION PATENT.

The Gray patent, No. 593,720, for a coin-controlled telephone pay station, embodies the first device based upon the idea that the pay-box signal, produced by the falling coin, should be communicated to the transmitter by means of resonant connection between the two, as contrasted with the employment of air waves, as in the prior art. It discloses invention and is not limited to the particular form of connecton described, nor was the right to such broad construction lost by anything which occurred in the patent office. Also, *held* infringed. *Gray Telephone Pay Station Co. v. Baird Mfg. Co. U. S. Circuit Court of Appeals.* 174 *Federal* 417.

LIABILITY FOR DEATH OF LINEMAN.

To determine the liability of a telephone company for the death of a lineman employed to straighten leaning poles, by the fall of a pole which he climbed, the inquiry is whether the company knew that the pole was less than the usual depth in the ground, and whether the servant knew that fact, and appreciated the risk peculiar to the work of straightening it because of that fact, and whether the fact that the pole was in the ground but 2½ feet, instead of the usual 4 feet, was an abnormal condition, and whether the company used ordinary care to notify him of the dangers peculiar to the service because of that fact. *Willis v. Plymouth & C. Telephone Exch. Co. Supreme Court of New Hampshire.* 75 *Atlantic* 877.

INFRINGEMENT OF PATENT.

The Herzog patent, No. 628,464, for an electric signaling apparatus and circuit used principally to enable guests in hotels by means of latent signal transmitters in the rooms to signal the office, embodies a system of bidirectional signaling to a limited extent only, it being possible to signal from the office to a room only when the transmitter in the room is set for a signal to the office, and is not infringed by the system of bidirectional signaling in use in a telephone exchange. *Herzog v. New York Telephone Co. U. S. Circuit Court of Appeals.* 176 *Federal* 349.

AMOUNT OF DAMAGES FOR PERSONAL INJURY.

When injured, a telephone lineman was young, vigorous, healthy, and industrious, but his injuries made him a permanent cripple, capable of performing manual labor of only the lightest kind. He suffered intensely, and would suffer for the rest of his life. *Held*, that a verdict for $11,500 was not excessive. *Citizens' Telephone Co. of Kentucky* v. *Wakefield. Court of Appeals of Kentucky.* 126 *Southwestern* 127.

GRANT OF FRANCHISE.

Under Const. sec. 164, providing that, before granting a franchise or privilege for a term of years, a city shall, after advertisement, receive bids therefor publicly and award the same to the highest and best bidder, an ordinance granting a telephone franchise is void, unless it be shown that the grant was to the highest and best bidder. *Watson v. City of Morehead. Court of Appeals of Kentucky.* 125 *Southwestern* 724.

DAMAGES FOR INJURY FROM TELEPHONE.

Where a young man injured while using a telephone by lightning being conducted over the wires was severely shocked and suffered greatly for several weeks after the injury, and the hearing in his right ear was impaired, and in the other was completely destroyed, a verdict of $5,900 was not excessive. *Southwestern Telegraph & Telephone Co. Supreme Court of Arkansas.* 126 *Southwestern* 724.

RECEIVING PAYMENT.

Under a contract to furnish telephone service for a month, renewable by payment of the rental in advance for the next month, a tender of the rent to a lineman who came to disconnect the phone for nonpayment of the rent is not a tender to the company, since he had no authority to receive payment. *Southwestern Telegraph & Telephone Co. v. Luckett. Court of Civil Appeals of Texas.* 127 *Southwestern* 856.

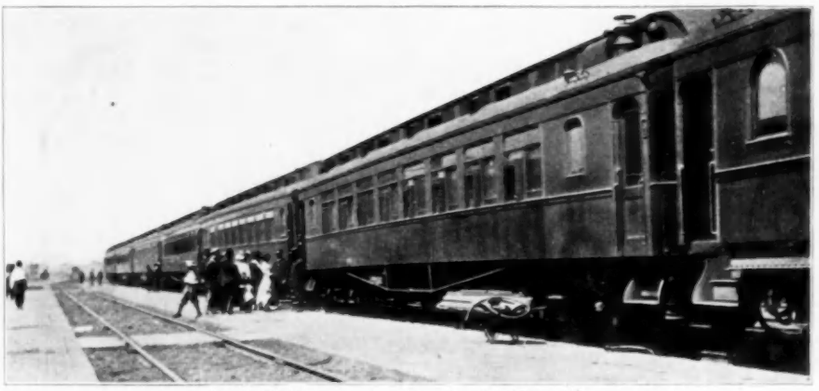
LEASE OF TELEPHONE.

A contract providing that telephone service would be furnished for one year, and that at the expiration of the year the lease should be considered renewed from month to month on the payment of the stipulated sum in advance, after one year the contract was only for one month, renewable on payment in advance for the next month. *Southwestern Telegraph & Telephone Co. v. Luckett. Court of Civil Appeals of Texas.* 127 *Southwestern* 856.

DAMAGES FOR CONSTRUCTION OF TELEPHONE LINE.

The measure of damages to a landowner by the construction of a telegraph and telephone line in the street in front of his home is the difference in the market value of the property before and after the construction of the line. *Southwestern Telegraph & Telephone Co. v. Smithdeal. Court of Civil Appeals of Texas.* 126 *Southwestern* 942.

DEPARTMENT of RAILWAY TELEPHONES



Santa Fe No. 10, with Cars for the Convention.

Railway Telegraph Convention Report

Photographs by M. E. Launbranch

THE twenty-ninth annual convention of the Association of Railway Telegraph Superintendents, held at the Hotel Alexandria, Los Angeles, Cal., June 20 to 25, proved to be one of the most important meetings in the history of the association. There was a large attendance of railway telegraph officials and associate members from all parts of the United States, Canada and Mexico, nearly all of the leading railroads of the country being represented. Important topics pertaining to railroad operation were discussed at each session.

Messrs. Lee, Hubbard, Wilbur, Ditch, Minton, Ryder and Chenery, Mesdames Lee, Hubbard, Wilbur and Chenery, and Miss Lee at Las Vegas.

Owing to the resignation of J. L. Davis, president of the association, some three months ago when he severed his connection with the railroad telegraph service, the meeting was opened at 1:30 p. m., June 20, by I. T. Dyer, superintendent of telegraph of the San Pedro, Los Angeles and Salt Lake Railroad, and first vice-president of the association.

After the usual greetings and welcoming of the visitors, the freedom of the city was extended to its guests by Joseph Scott, president of the Los Angeles Chamber of Commerce, to which response was given by E. P. Griffith of New York, superintendent of telegraph of the Erie Railroad.

In the absence of the secretary, P. W. Drew, F. H. Van Etten, superintendent of the Southern Indiana Railroad, Chicago, was elected secretary pro tem, and William Bennett, superintendent of telegraph of the Chicago and Northwestern Railway, also of Chicago, was elected treasurer. George A. Cellar, Pittsburg, superintendent of telegraph of the Pennsylvania Lines west of Pittsburg, and John B. Sheldon, superintendent of telegraph of the Union Pacific, Omaha, were added to the executive committee.

The report of the secretary and treasurer, P. W. Drew, showed the affairs of the association to be in a very satisfactory condition.

A resume of the work done by the western division of the association during the past year was given by E. A. Chenery, superintendent of the Missouri Pacific Railroad, St. Louis.

A paper on "Composite Telephone Blocking" was read by W. F. Williams, Portsmouth, Va. Owing to the absence of S. P. Ryner, his paper on "Automatic Block and Highway Crossing Signaling" was read by William Bennett. The first day's session closed with the election of new members.

The second day's session opened with a report from E. P. Griffith, chairman of a committee appointed by the eastern division of the Association of Telegraph Superintendents, to confer with officials of the telegraph companies for the purpose of establishing an adequate and uniform system for the delivery of commercial telegrams to pas-

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical developments, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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Mr. I. I. Dyer. Mrs. J. B. Sheldon.

Mr. E. K. Dyer, Miss Dyer and Mrs. Klipple.

Mr. E. K. Dyer at Long Beach.

sengers on trains, which was followed by a lengthy discussion.

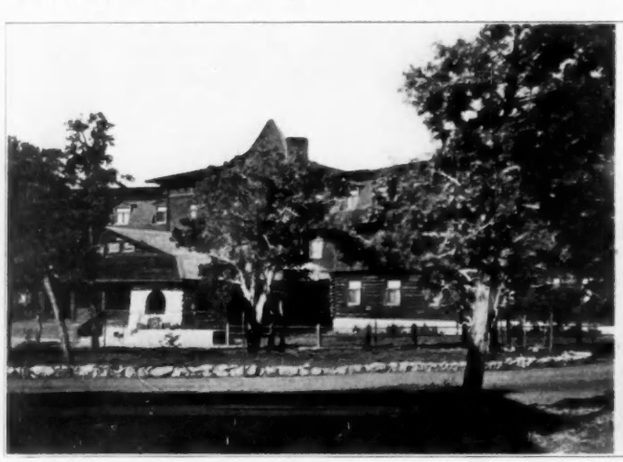
The committee commended very highly the general order regarding this matter issued by the Pennsylvania Lines in 1905 and expressed its belief that were this order adopted by other railroad lines, great progress would be made.

It was also suggested by the committee that the association recommend to the General Managers' Association, and the General Passengers' Association as well, that a general order be issued by the railroad companies instructing their agents and other station employees to aid the telegraph company's messenger to reach directly the conductor of the train, and instruct the conductor to receipt on the telegraph company's regular delivery receipt forms for the messages addressed to his train or in his care; and in case he is unable to make delivery, to send it back to the agent of the station where the message was delivered to him, who shall notify the telegraph company over whose lines the message was handled to call at his office for undelivered telegram.

A committee of five was appointed to consider the subject and formulate a plan within the next ninety days, which would insure proper delivery and notice of non-delivery of messages.

M. E. Launbranch read an excellent paper entitled "Protecting Telephone Lines from Lightning and Other Disturbances." A very instructive and interesting paper on "Wireless Telegraphy as Applied to Railroad Lines" was read by Dr. Lee DeForest, which brought out considerable discussion. In reply to the question as to whether it would be possible for two passenger trains traveling in opposite directions to carry on telephone communication over distances of two miles, Dr. DeForest replied that it would, and that if limited passenger trains were equipped with a dynamo instead of batteries, communication over a much longer distance would be possible. Inquiry was made as to what experiments had already been carried on in telegraphing to moving trains and the statement was made that the first experiments with the wireless telegraph were made on the Chicago and Alton in 1905 and that last year the Frederic Thompson theatrical special "Via Wireless" train from New York to Chicago was equipped with a telegraph transmitter and several trackside wireless stations installed for the purpose of keeping in touch with this train throughout its journey. These tests, it is said, were quite successful.

The subject of high tension crossings was discussed at some length and the plan considered at the



Hotel El Tarar, Grand Canyon.

Station at Williams, Arizona.

last session of the association was officially adopted.

The committee which had been appointed at the regular quarterly meeting of the eastern division of the Association of Railway Telegraph Superintendents, held in Washington, D. C., November 18, 1909, to consider the proposed standard railway telephone agreement recommended, in view of the new and important feature which has entered the telephone and telegraph field during the current year, that the association should postpone acting upon the acceptance of the standard telephone operating agreement of railroads until the telephone and telegraph companies have further developed their traffic arrangement. The association will then be in a better position to judge as to the service of the various railroads, and when such time shall arrive a committee representing the association can meet, in joint session, with a committee representing the American Telephone and Telegraph Company, and formulate an agreement suited to the conditions.

The report was accepted with the amendment that such railroads as may require some form of contract before the next annual meeting of the association, accept the proposed agreement for one year, thus giving it a trial.

Messrs. Peck, Ditch and Sigison and the Ryder Boys at Las Vegas.

The membership of the association as announced at the beginning of the convention by Secretary Van Etten was 116 active and 63 associate, making 179. During the convention, however, a large number of members were added as follows:

New Members: F. S. Worth, chief despatcher, Lehigh and Hudson River Railway, Warwick, N. Y.; H. C. Chace, assistant superintendent of telegraph, Atchison, Topeka and Santa Fe Railway, Los Angeles, Cal.; J. H. Lindsey, superintendent of telegraph of the Northern Railway, Costa Rica, Central America; J. Wilson, superintendent Canadian Pacific Railways' telegraph, Vancouver, B. C.; E. D. Hubbard, general foreman, Grand Trunk Railway, Battle Creek, Mich.; J. F. Caskey, superintendent of telegraph, Lehigh Valley Railroad, So. Bethlehem, Pa.; E. W. Mason, superintendent of telegraph, Western Pacific Railway, San Francisco, Cal.; C. T. Day, assistant superintendent of telegraph, Southern Pacific Railway Lines in Mexico, Sonora, Mex.; G. H. Leverett, telegraph and telephone engineer, Chicago, Milwaukee and Puget Sound Railway, Seattle, Wash.; J. C. Johnson, superintendent of telegraph, Pennsylvania Railroad, Philadelphia, Pa.; G. J. Bayliss, general foreman, Southern Pacific Railway, San Srancisco, Cal.; Wm. Knowd, telegraph manager, Gulf, Colorado and Santa Fe Railroad, Galveston, Tex.; Geo. N. MacDonald, signal engineer, Virginian Railway, Norfolk, Va.; J. W. Murphy, superintendent of telegraph, Mobile and Ohio Railroad, Jackson, Tenn.; T. M. A. Haston, superintendent of telegraph, Toledo, St. Louis and Western Railroad, Bloomington, Ill.; A. T. Hollenbeck, superintendent of telegraph Chicago Great Western Railroad, Chicago, Ill.; J. T. Nolan, chief operator, Washington Terminal Company, Washington, D. C.; H. L. Husted, division operator, West Jersey and Seashore Railway, Camden, N. J.; F. S. Fender, assistant superintendent of telegraph, Southern Pacific Railroad, San Francisco, Cal.; W. F. Taylor, division operator, Pennsylvania Railroad, Altoona, Pa.; J. H. Ditch, telegraph inspector, Pennsylvania Railroad, Altoona, Pa.; E. C. Keenan, superintendent of telegraph, Lake Shore and Michigan Southern Railroad, Toledo, O.; J. H. Mahon, superintendent of Canadian Pacific Railway's Telegraph, St. John, N. B.; E. W. Mersereau, superintendent of construction, Canadian Pacific Railway's Telegraph, St. John, N. B.; W. H. Hall, superintendent of telegraph, Missouri, Kansas and Texas Railway, Denison,

Just Before Leaving Grand Canyon. Messrs. Minton, Swan, Bennett, Griffith, Williams and Starkweather. Mesdames Williams, Gattis and Chenery and Miss Williams.

Messrs. Camp, Douglas and Bennett and Mesdames Ryder, Hubbard and Chenery Bartering with the Indians.

Coaching on Smiley Heights at Redlands.

Tex.; P. Robinson, chief train despatcher, Algoma Central and Hudson Bay Railway, Sault Ste. Marie, Mich.

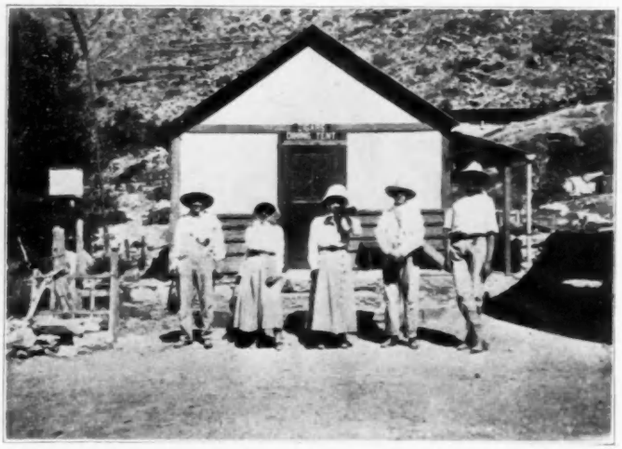
Associate Members Elected: G. W. Swan, representative, John A. Roeblings Son's Company, New York; G. M. Marshall, engineer, National Carbon Company, Cleveland, Ohio; C. H. Fuller, commercial superintendent, American Telephone and Telegraph Company, New York; G. W. Peck, commercial department, American Telephone and Telegraph Company, New York; F. R. Chambers, Jr., vice-president, Duplex Metals Company, New York, W. M. Page, manager, Duplex Metals Company, New York; H. D. Currier, engineer, Duplex Metals Company, New York; R. A. Peterson, vice-president, Watson Insulated Wire Company, Chicago, Ill.; P. J. Eubanks, sales manager, Sandwich Electric Company, Sandwich, Ill.; J. H. Kinnard, Bell Telephone Company, Philadelphia, Pa.; A. F. Ormsbee, special agent, New York Telephone Company, Brooklyn, N. Y.; Wm. Prescott Hunt, vice-president and secretary, Buda Company, Chicago; E. K. Dyer, salesman, Western Electric Company, San Francisco, Cal.; R. W. Gillette, electrician, Western Union Telegraph Company, San Francisco, Cal.; C. N. Sigison, United States Electric Company, New York.

Honorary Members Elected: J. B. Fisher, ex-superintendent of telegraph, Pennsylvania Railroad; G. H. Groce, ex-superintendent of telegraph, Illinois Central Ry.; S. K. Bullard, ex-superintendent of telegraph, Missouri, Kansas and Texas Ry.; William Kline, ex-superintendent of telegraph, Lake Shore and Michigan Southern Railway; John L. Davis, ex-superintendent of telegraph, Chicago and Eastern Illinois Railway; E. E. Torrey, ex-superintendent of telegraph, Mobile and Ohio Railroad; W. T. Gentry, president, Southern Bell Telephone and Telegraph Company; E. J. Hall, chairman, executive committee, Western Union Telegraph Company; E. C. Bradley, vice-president and general manager, Pacific Telephone and Telegraph Company.

Messrs. Swan and Bennett at the Bottom of Corkscrew Trail, Grand Canyon.

All who attended the convention were profuse in their praise of the hospitality and kindness extended and the entertainment committee is to be congratulated on its success along this line. Although the time to be devoted to sight-seeing was very limited, everything had been so carefully arranged as to utilize every moment to the best advantage.

Through the courtsy of the Los Angeles Pacific Railway, the visitors enjoyed a trip over the Balloon Route to Santa Monica, Ocean Park, Venice, Redondo and other points of interest. A special train on the Pacific Electric Railway conveyed the party to Mt. Lowe. A



Messrs. and Mesdames Wilbur and Lee at a Half Way House, Grand Canyon.

banquet was held at the tavern after which the party went for a moonlight ride and a visit to the observatory. On Thursday a trip was taken over the kite shaped track of the Santa Fe Railway, a special train being provided by the management of that system. Luncheon was served at the famous Glenn Inn, Riverside.

On Saturday the visitors made a trip to Avalon, Santa Catalina Island, where dinner was served and the day spent in bathing, fishing and other outdoor sports and all left feeling it was good to have been there.

All the luncheons, banquets and tally-ho rides were furnished by the Appliance Association.

The following committees have been announced by President Dyer:

Executive Committee—I. T. Dyer, chairman; J. B. Sheldon, William Bennett, C. Selden, E. A. Chenery and P. W. Drew.

Entertainment Committee—S. A. D. Forristall, N. E. Smith, W. Marshall, M. Magiff, B. A. Kaiser, P. W. Miller and A. P. Eckert.

Auditing Committee—A. B. Taylor and L. A. Lee.

Committee on High Tension Wire Crossings: G. A. Cellar, chairman, G. H. Groce, W. W. Ashald, W. P. Cline, C. Selden, C. A. Parker, J. M. Walker, Wm. Bennett and S. A. D. Forristall.

Committee on Miscellaneous Matters—W F. Williams, chairman, S. L. Van Akin, F. T. Wilbur, W. W. Ryder and Geo. Boyce.

Committee on Resolutions—E. P. Griffith, W. J. Camp and E. W. Mason.

Topics Committee—W. C. Walstrum, W. L. Connelly and E. A. Klippel.

Protecting Railway Telephone Lines

By M. E. Launbrauch*

THE protection of telegraph lines from lightning and other disturbances is assuming more and more importance with the increasing use of high voltage power transmission; and as the telephone is extending into new fields.

Although the telephone is in a high state of development at the present day, there is still a great deal to be desired; and each time a new field is entered, new conditions arise, so that the telephone engineers are kept constantly busy meeting such conditions and developing new schemes for improvement of service. The rapid development of other branches of electrical transmission such as power transmission lines, lighting circuits and trolley roads, in all parts of the country, has multiplied the troubles of the telephone circuit; which, not many years back, held undisputed sway throughout the rural districts, and literally possessed the earth and compelled it to do part of its work, as ground circuits were most common then. These ground circuits are rapidly being driven out of existence, by these other circuits of high potential taking possession of the territory.

In addition to these we have the ever present atmospheric conditions to contend with, such as lightning and other static disturbances. All high tension lines are circuits for the transmission of electrical currents with inanimate machines to transmit and receive the power while the telephone line is a circuit for the transmission of human intelligence and a human being is the generating and receiving machine.

In the first group of circuits we must protect property from injury or destruction caused by the atmospheric disturbances or disturbances created within themselves. But on a telephone line we must provide protection not only against disturbances, injury or destruction of property, but against injury and annoyance to the user.

As stated in our subject, we shall confine ourselves to the protection of telephone lines, and more especially to lines in railway service. Let us first take disturbances from lightning. These are of two kinds, direct, and indirect or induced. Fortunately the most destructive is the least experienced; namely, the direct flash. And this is certainly very fortunate when we realize that no very effective protection has ever been designed to guard against its destructive effects, such as destroying entire cable terminals, melting heavy copper leads and instruments. By far the greatest amount of lightning disturbance is caused by induced charges, and these range from those that burn out the coils, transmitters and receivers, to the annoyance experienced by a despatcher getting a crack in the ear from the static charge passing from one wire to the other through his receiver, or the surging and snapping one hears on long lines during electric storms, and even in dry snow storms.

*Paper read at the Los Angeles convention.

PROTECTION FROM DIRECT FLASH.

As stated previously, no real successful protection against direct lightning flashes has been designed for telephone lines, or at least none which would be considered commercially economical considering the small per cent of loss due to such causes. A protector for such a purpose must have large carrying capacity and low resistance to lightning discharges. Such protectors have been designed for use on power transmission lines and are of two types, electrolytic, and multiple air-gap combined with resistance. Such arresters are not only for the protection of lines from lightning, but from excessively high potentials created within themselves.

It is a question whether protection can be provided to guard against such disturbances, when we consider the enormous energy in a discharge which has pierced through an air-gap often times over a half mile in length, so that the remaining distance after it hits the line amounts to very little. It will often not even go down the ground-lead, but will melt the wire it first hits and then shoot off through the air and hit some adjacent object, no matter how good a ground you may have, although a ground should always be of the best. Of course, these direct flashes vary in intensity and every possible means should be provided to take care of them; and there is no doubt that a despatcher's line or message wire is far better protected against such disturbance than the ordinary single station telephone line, due to their being equipped with arresters at every station which act like a long drawn-out picket fence of grounds which do a great deal towards dissipating the charge by assisting in preventing its concentration toward one point.

As stated before, destruction from a direct flash is very rare, and even when a line is struck, the energy of the flash is so great that it does not always follow the turns and twists of the wire entering a building. This is the reason one so seldom hears of a person being injured by lightning while using a telephone, which speaks well for the present day protection; and this is especially true of the dispatcher's line, as the writer has heard of only one burnout in two years on any such circuits, and no one was injured in the slightest degree at that time.

PROTECTION FROM INDUCED CHARGE.

It is oftentimes hard to distinguish between a direct flash and an induced discharge from the damage done, as an induced discharge is sometimes so intense that it causes as much destruction as a direct flash—at

least, its practical results are just as serious as far as putting the line out of service, and also, as to its being dangerous. As stated before, that although this trouble, due to induced discharge, constitutes by far the greatest per cent of all the disturbance experienced on telephone lines, only a small portion of this is dangerous to persons; the greater portion being such as to cause annoyance to the service. The majority of these troubles may be enumerated as follows: Burned out coils in relays, bells, and receivers; punctured condensers; conductors in cables destroyed; insulation in cables reduced by charring of insulating material; blowing holes through sheaths of cables, thus letting in water and putting cables out of business.

The so-called burning out of coils often consists of discharge taking place between different layers of the winding, and either short circuiting the coil or fusing of the wire, as it is often very fine; and thus opening the coil. Very often, however, the energy of the discharge is so great that the coil is entirely destroyed in dissipating the heat. In puncturing condensers it often occurs that after the discharge takes place, enough current follows to burn out the cross between the plates, leaving it as good as ever, so that the trouble-man is mystified when he sees evidence of lightning having passed through the condenser and still finds it O. K.

I have gone somewhat into detail in the foregoing, so that we may have clearly before us just what we must protect against.

PROTECTION OF APPARATUS.

To protect our apparatus it is very evident that we must provide a path for the static charge, of a lower resistance than that found between windings of fine wire, with thin insulation on the coils and between plates of condensers, as these are the weakest spots that must be protected. The first attempt at lightning protection to telephones was the toothed plates mounted closely to the ground plate, similar to that used in telegraph service. This served the purpose to some extent, but was not as efficient as protectors of later design. The protector now most used consists of carbon blocks separated by very thin sheets of mica. Although these protectors are of various designs, the principle is the same; namely, the flashing of the discharge between the carbon blocks across the intervening air-gap. Some such arresters are provided with a piece of fusible metal set into the center of one of the carbon blocks so that in case a discharge is followed by a volume of current the carbon becomes heated enough to melt the metal, which in turn forms a solid conducting path to ground, thus putting a dead ground on the line and blowing the fuse. This type of arrester has proved very efficient on the lines of telephone companies, and is used almost exclusively in exchange service.

As the telephone commenced to be used more extensively in railway service, new conditions arose which gave trouble and had to be met. One trouble with the regular carbon mica arrester is that it does not always clear itself after each discharge. The consequence is that after a discharge there is generally left a dead ground on the line, or one of high resistance which is often enough to cause a noise. This is not of so much consequence on the ordinary exchange line where there are only few arresters, which are so located that the carbons are easily removed and cleaned.

On railway telephone lines another condition is met with; namely, that instead of from two to a possible ten telephones being on the line, there are from twenty to even a possible sixty, with an arrester at each station. Under such circumstances it becomes necessary to have an arrester which will remain clear after each discharge, as here it is not only a question of protection, but that the service shall continue uninterrupted, as the business on these lines is of such vital importance compared with what might be going over a farmer's line which can stand having poor service for a possible half day, due to some protector being grounded.

About seven years ago, in making a study of telephone requirements on trolley roads, this question of high resistance grounds was one of the first difficulties we had to deal with. It was found that the regular carbon-mica arrester, although it might not always become heavily grounded, would still give a high resistance ground due to fine particles of carbon lodging on the edge of the mica. These high resistance grounds would not be noticeable where there were only two or three instruments on the line; but when a greater number were connected these grounds having multiplied, they produced heavy noises on the line, this also being intensified because of the fact that these lines run parallel with high tension circuits, often on the same pole. To do away with this trouble a great deal of experimenting was done to find a substitute for the carbon block, by trying different kinds of metal such as aluminum, zinc, brass and copper. Sand blasting the surface to produce points was tried. The outcome of these experiments was the present copper block and mica arrester, which is quite extensively used. This arrester although it has cleared away a great deal of trouble due to carbon dust, still has a path on the ragged edge of the mica for the accumulation of dirt, and possible carbon dust from smoke. It does not fully take care of the discharge from one wire of the circuit to the other, which more frequently finds escape through the despatcher's receiver than across the air-gap of the arrester. To do away with the trouble caused by the accumulation of dust on the edge of the mica, and also, to take care of heavy flashes, a number of arresters have been designed in the last few years. As an example of this type might be mentioned the O'Connell which is quite extensively used on dispatching lines. This consists of large carbon blocks widely separated by insulation and set in V position in relation to each other, so that at the point of the V the edges nearly meet, this being the point of discharge. This arrester has proved quite efficient as it not only clears itself quite readily on a small discharge, but it has a capacity to carry heavy discharges and of caring for heavy flashes by blowing them out by means of its V-shaped air-gap. There are also other types of arresters which are designed to carry heavy discharges of different designs.

Of two later arresters put on the market one uses a partial vacuum for an air-gap between two carbon plates known as the "Vac-M;" the other is a departure from the air-gap principle entirely, and might be termed a direct contact arrester and consists of carbon blocks being separated by means of a composition block instead of an intervening air-gap, and it is known as the Brach arrester. As these two arresters are of quite recent origin we are not able to give any extensive data as to their efficiency under all condi-

tions on the telephone lines. It might be stated, however, that these two seem to be lightning arresters pure and simple, and will not protect against power circuits of low potentials. However, they have the advantage of taking care of lightning discharges repeatedly, without leaving any ground on the line.

In the "Vac-M" the discharge takes place in the form of a brush discharge between two carbon plates across a partial vacuum. In the Brach arrester, the discharge takes place between two carbon blocks through the intervening static conducting composition block. It would seem that an arrester of this type gives promise of quite an improvement for taking care of the greater percentages of troubles and annoyances on railway telephone lines. The composition acts as a nearly perfect conductor for highly oscillatory current such as lightning and static charges, while it is of high ohmic resistance for direct currents.

This composition arrester has been in service on block systems for two years and has given very satisfactory service. A number have recently been put in service on telephone lines and we see no reason why they should not clear away considerable of the trouble not being cared for by the present air-gap arresters; namely, the annoyance of minute static discharges on railway telephone lines, and toll lines, and at the same time keeping the line clear of grounds.

At that point, I again wish to call attention to the fact that a train dispatcher's and message service lines on railroads are far better protected than the regular long lines of telephone companies, on account of their having a number of arresters distributed all along the line; and I believe I am making a conservative statement when I say that injuries to apparatus on these lines have been very rare.

If an arrester can be produced which will care for static discharges without permanently grounding, and of high enough ohmic resistance to prevent leakage, there is no reason why this system of protection, namely, distributing arresters along the line, should not be adopted on regular long distance lines.

PROTECTION FROM HIGH TENSION CIRCUITS.

Railway telephone lines being run on the railroad's private right of way are probably more free from the danger of high tension crossings than the lines of telephone companies; still with the ever increasing growth of high tension circuits the protection against these sources of danger is becoming more and more necessary in the more populous districts. The chief step to be taken in connection with protecting these lines is, of course, the high tension crossing which has already been thoroughly covered by the association specifications for these crossings. This, however, does not remove the necessity for providing protection on the lines themselves, where crossing from such circuits are made possible by their presence. The methods in use for such protection are the lightning arrester and fuses.

The same lightning arrester discussed under protection from lightning, serves this purpose quite well; namely, the carbon arrester, with small enough air-gaps to permit the flashing across of potentials, say 350 volts and over, and to fully protect the apparatus. In such cases a fuse should be provided which will open when the current flows which follows the discharge.

As the standard commercial fuse will not always take care of the opening of a circuit where crossed with a very high tension wire, other methods have been employed to protect the line; namely, where the dangers of such possible crosses occur, a section of the line is so constructed that in case it is crossed by the high tension wire, that section will disconnect itself and drop out, thus making a break long enough to extinguish the arc.

SUMMARY.

Taking the whole subject of arresters we have the following conditions: The carbon air-gap arrester is necessary to protect lines from crossing with other circuits of 350 volts and over, and the heavier lightning discharges followed by current. An arrester of efficient static carrying capacity is desirable to take care of the larger percentage of troubles and annoyances due to static discharges. It would, therefore, seem that an arrester which would take care practically, of all the troubles on railroad telephone lines should consist of large carbon blocks with a small air-gap at one point the blocks to be insulated from each other by means of a highly efficient static carrying material; such material to be of high ohmic resistance, to prevent leakage to such an extent that it will not produce noise on the line; or a combination of two types of arresters could be used; namely, the static arrester connected direct to the line without fuses and the carbon arrester connected through fuses to protect the instruments.

LOCATION OF PROTECTORS.

The most desirable location of protectors is, no doubt, outside of the buildings, although the greatest number of them are located on the inside, and apparently without very much risk, as the number of cases of disturbances from lightning and high tension circuits which would cause danger to buildings are very few. However, the best place to locate an arrester, especially for protection against lightning, is on the pole. A very efficient way of connecting such an arrester is to mount it on the cross-arms between the pins of the wires to be protected, connecting the carbon block directly to the line wire; and at this same point connecting the drop wire which is to enter the building. This drop wire, immediately after leaving the connection on the lightning arrester or line wire, should be wrapped several times, either around the pin below the insulator of the wire to which it belongs or around the cross-arm before it is extended into the building. This you will observe gives you a highly efficient choke coil that in case of lightning discharges, forces the current to ground through the lightning arrester instead of permitting it to enter the building. If a fuse is desired, one side of this should be connected directly to the line wire, the other side can act as the terminal for connecting the one side of the arrester and the drop wire.

The objection to having a fuse located on a pole is its inaccessibility. It is, therefore, recommended that for railway service, the fuses be omitted on the pole arrester, but that it be installed ahead of the instrument in the building. Another advantage of having arresters mounted on the pole is that it permits a most direct and straight lead, as this is more desirable to take care of lightning discharges and prevents side flashing to quite an extent.

For ground leads iron wire is just as good as copper. Another objection to a fuse on a pole arrester is that these arresters are primarily intended to take care of the greater per cent of static discharges which

are mostly of such a character that they do no serious damage, only cause annoyance, and still are often severe enough to blow a fuse, which proves a source of great trouble and is of no practical service.

PROTECTING CABLES.

In the protection of cables, lines before entering the cables should be provided with fuses to prevent excess current getting in and destroying the conductors, or charring the insulating material, which would reduce the insulation; where cables have terminal boxes a loop or goose-neck should be formed, as it has been found that where lightning succeeds in entering a cable at a terminal box, and there has been such a loop or goose-neck, the charge has, nearly without exception, discharged itself out through the sheathing at this loop or goose-neck, leaving a hole very much as though a bullet had been shot from the inside. It is better to have this occur at this point, where the cable can be easily repaired or boiled out in case of water having entered, than to have it penetrate further in. Such blow-outs are generally caused by heavy discharges which destroy the fuses and get beyond them.

In a study made several years ago, on damage done by lightning on cables of one of the telephone companies, it was found that this was a fact nearly without exception. In one case where the cable came straight down the pole out of the terminal head and went under ground, it was found that the discharge through the sheathing had taken place where it made the turn in the manhole and entered the conduit, making it necessary to pull out the cable to make repairs.

OTHER DISTURBANCES.

As we have made lightning protection the principal feature of this paper, we will just briefly mention other disturbances. Of course, such other disturbances will chiefly be induction due to paralleling circuits. Transposing of lines take care of the ordinary disturbances due to adjacent telephone and telegraph disturbances. Such transposition will, of course, depend upon the paralleling circuits to be contended with. The most extreme cases to handle are paralleling high tension circuits, and especially if these high tension circuits are very close and have a large carrying capacity. We have met with cases where the induced effect from such circuits on a telephone line have been such that it has produced a current to ground direct from the telephone wire, of as high as three and four amperes; and in taking a volt meter reading to ground it has amounted to 200 volts, and in one case in attempting to take a volt meter reading the meter was burned out.

This will be appreciated when it is realized that a telephone wire being adjacent to a high tension A. C. transmission line is simply a good conductor directly in the magnetic field. The consequence is that the telephone wire will not only have a high static charge but will also be a conductor of electro magnetic current, being in reality one coil in a transformer. A very efficient way of caring for this trouble has been the drainage coil. This consists of a well-balanced retardation coil bridged across the line, the center being connected to ground. These coils are connected at intervals along the line, depending upon the amount of induced current it is necessary for them to carry off. Of course, the wire in these coils must have enough carrying capacity to take care of the current to prevent burning them out. This coil also keeps down the static charges.

tall Station Telephone

The Missouri Pacific railroad must put a telephone in its freight and passenger station at Panama, Neb., for the benefit of the public.

Judge Frost sustained the demurrer of the state in the case of the Missouri Pacific railway against the state railway commission, which declared that the facts alleged in the petition were not sufficient to constitute a cause of action.

On March 8 the commission issued an order to the railroad to install a telephone in its depot in the town of Panama, connecting with the telephone exchange of the Farmers' United Telephone Company there, for the use of the agent in answering inquiries of the public, the telephone to be installed by March 28.

The Missouri Pacific refused to obey and brought suit in the district court, asking it to prohibit the enforcement of the order of the commission.

It was maintained by the plaintiff that the town of Panama has but few inhabitants and but little business or traffic coming to it and there was no reasonable necessity nor was there any demand from the public to install and maintain a telephone for its convenience.

It was also alleged that the Farmer's Telephone company and all other telephone corporations in the state are common carriers required to serve the public and it should be its duty to install and maintain an instrument at its own expense. It was pointed out that there was no more justice in the railroad paying for a telephone owned by the Farmers' company than to compel the latter to maintain and operate a railroad for the benefit of patrons. The plaintiff advanced the argument that the order of the commission was a denial of its constitutional rights and privileges.

Union Pacific Installs Telephones on Cut-Off

There have just been installed at all the stations on the Topeka-Marysville (Kansas) cut-off, the new Union Pacific short cut to the coast, telephones for the use of the different stations and train crews only. The telegraph wires are used for transmission of messages. By this arrangement the crews of trains operating on this cut-off, when such service is finally established, will be enabled to secure orders en route at stations where no night operator is stationed as each station on the route can be called up independently of the other and each station has its own individual ring or call.

Electric Road Installing Telephones

The Chambersbury & Gettysburg Electric Railway Company has completed stringing wires for a private telephone system along its line in Chambersburg, Ill., and between that place and Caledonia park. Telephones are placed at each of the switches and the cars equipped with telephones.

Jack boxes are erected about every 1,000 feet, thereby giving immediate connection from almost any point along the line. It will greatly improve the service, making it impossible for a car to be out of service without the dispatcher knowing of its whereabouts.

Dispatching in the Coal Fields

By Clifford Weldon

TELEPHONE train dispatching circuits have been in constant use on the Mahanoy and Hazleton division of the Lehigh Valley Railroad since last December. According to Mr. J. F. Caskey, superintendent of telegraph, under whose direction the new dispatching system was installed, it has been a greater success than had been anticipated. The task of equipping the road with dispatching circuits was done with every attention to thoroughness and detail from the very beginning, and this division of the Lehigh is today one of the best equipped in the country in this respect.

The dispatcher is located at Hazleton. One of the accompanying illustrations (Fig. 1) shows him at his post with his copy operator. The greatest distance of any way-station from this office on the Mahanoy and Hazleton division is thirty-seven miles. When the branches are considered, the total mileage of the division is ninety-seven.

There are thirty-six selector stations and ten siding telephones. This is a very busy section, handling the bulk of the anthracite coal traffic. In the course of twenty-four hours, between 150 and 240 orders are handled by the dispatcher. From 80 to 100 trains a day are moved over the tracks of this division, and all of these movements are regulated by the telephone.

Fig. 1. Dispatcher's Office at Hazleton, Pa.

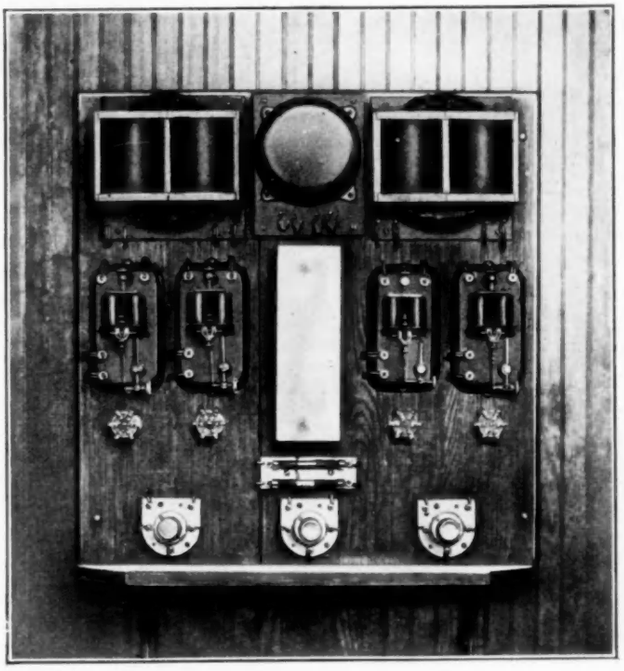


Fig. 2. Apparatus for Signaling, Mounted on Wall.

Since these circuits were put into service on Dec. 6, 1909, practically no trouble has been experienced. The greater part of the traffic along the line is freight, principally coal trains. This is particularly heavy traffic in the winter.

This work was previously handled by the dispatcher and a copier, or second dispatcher, who used a separate train wire. When the telegraph was supplanted, but one circuit was found necessary. The copier is now on the same line with the dispatcher all the time. This practically means that but one man is handling the circuit.

At the left of the dispatcher in the picture is shown a key box containing eight keys. These keys enable him to ring the siding telephones on any one of the three branch wires entering the office, or to cut off these branches in case of trouble, to make patches on any one of the three wires between the office and the first station and to operate the interrupter associated with the private branch switchboard.

The chief dispatcher is provided with a "listening in" set and the superintendent, Mr. G. J. Gildroy, has a similar equipment. Fig. 2 shows the apparatus for signaling mounted on a board. In the view are seen protectors and resistances, and in the center is a cable terminal. Cable extends from the terminal to a similar box on the dispatcher's table. Two sets of storage batteries furnish energy for signaling and for the transmitters at the dispatcher's office.

At each way-station a transmitter arm and test panel are installed.

The transmission at these way-stations is so loud and so distinct that the operators had to be trained to talk over these circuits in a lower tone than that of ordinary conversation.

The Mahanoy and Hazleton division was the first of the Lehigh divisions to be equipped with the telephone for dispatching trains. The telephone equipment for this division, as well as for all the lines installed since the successful operation of the Mahanoy and Hazleton circuits, was furnished by the Western Electric Company.

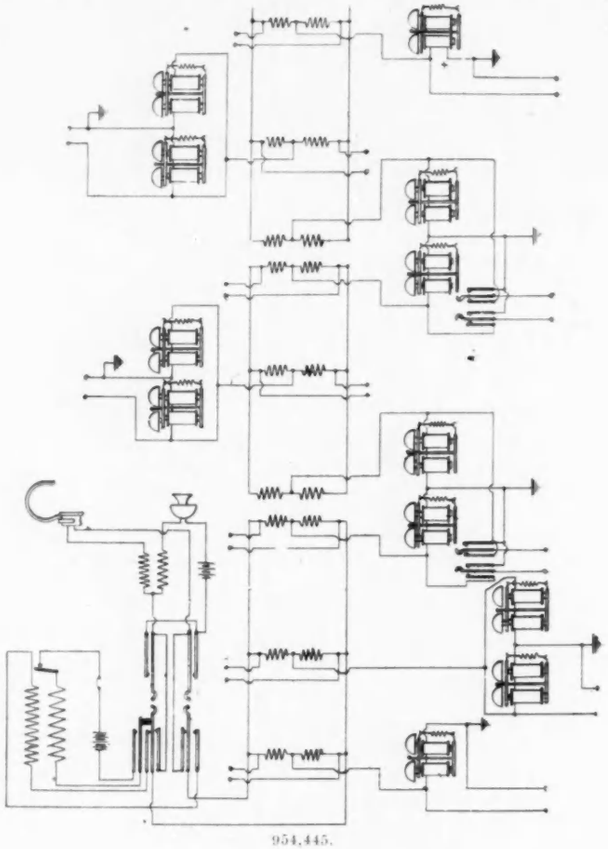
The signal success of this equipment in the coal field region has led the officials of the road to make further improvements along that direction on other parts of their system. The Lehigh division now has a similar equipment, between Easton and Penn Haven Junction. In New Jersey, telephone circuits are under construction between Jersey City and Easton, Pa. Another line is under construction on the Wyoming division between Sayre and Packerton. Arrangements are being made to extend the system over the Auburn and Buffalo divisions.

In addition to this, all passenger trains and cabooses on the Lehigh Valley are soon to be equipped with portable telephone sets and line poles to provide for communication at any point along the tracks.

Railway Telephone Patents

By David S. Hulfish

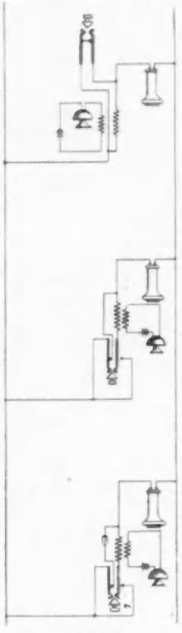
954,445 Party-Line. This system is suitable for telephone trains dispatching, and provides for communication from any station to the central office or train dispatcher's office, providing also for communication between any station and the next adjacent station in either direction. These conversations are independent, permitting several pairs of stations to talk to each other without interference, and also conversation may be held with the dispatcher's office without interference



954,445.

with any of the conversing pairs This result is attained by breaking the telephone line with a repeating coil at each station, thus cutting the line up into sections which are conductively separate but inductively connected. By the inductive connection, any station may talk to the dispatcher's office, but by the lack of conductive connection, a phantom circuit with earth return may be used from any station to the next without interfering with the conversation over the main line, and without interfering with conversations by other telephones upon the next or other sections. Oscar M. Leich Illinois, assignor to Cracraft-Leich Electric Company, of same place.

956,109. Line Transmission System. In the early days of long distance telephony, the transmitter was provided with a "shunt button." This button was arranged to shortcircuit or "shunt" the secondary winding of the induction coil. With the local battery circuit usually employed, the secondary of the induction coil and the helix of the receiver were placed in series across the line pair, compelling all received speech currents to pass through the secondary, where a portion of their energy was lost. By shunting the secondary, this loss



956,109.

was avoided, and the quality of received speech was improved for that reason. Another reason existed, namely, that by shunting out the secondary the line was freed from noises originating in the idle transmitter of the receiving station and the receiver thus was left unaffected by any currents other than those of the incoming speech transmission. Mr. Lademann has applied this principle of the shunt button for the secondary induction coil winding to the telephone station instruments of a line adapted for train dispatching service, with intent to improve the talking qualities of the line and to secure more reliable transmission from the dispatcher to the stations, and vice versa. Otto T. Lademann, Milwaukee, Wis., assignor to Railway Telephone and Electric Company, Chicago, Illinois.

Composited Telephone Blocking

By W. F. Williams

THE Seaboard Air Line has been blocking its trains by telephone over one of its most congested districts, a distance of 154 miles, four years, using an iron wire solely for this purpose with one telephone, two bells (one bell for north block and one for south block) and a switching key arrangement at each station. This circuit proved so successful that a little more than two years ago, we were called upon to extend the telephonic block fifty-three miles south, to be operated under the same conditions, i. e., one telephone at each station with bells or howlers, north and south, and a switching key arrangement to throw the telephone over on the north or south block as occasion would require.

Not having a spare wire available to do this, and wishing to avoid the expense of stringing one, we selected a circuit 175 miles long with thirty-five telegraph stations thereon and composited an intermediate fifty-three miles. On the fifty-three-mile stretch are located ten intermediate telegraph stations and eleven telephone stations, both operated simultaneously. The telegraph circuit works as well now as it did before, and while we know there is lag, we have not discovered it in the operation. The scheme has been a success from the first. This has been very gratifying because the iron wire that makes up this circuit has been in service for about forty years, and it would not be unnatural to expect some bad effects from this on the telegraph service. As a matter of fact, there has been no failure on this circuit since the telephone equipment was added to it, two or more years ago. The transmission obtained is perfect.

The line is composited in such a way that each station can call only the two adjacent stations, one north and one south, without calling any other station. At each station a portion of the windings of two repeating coils are cut into the telegraph line and the composited telephone sets are wired from the secondaries of these. These coils are for the purpose of reducing noise on the line and preventing interference between the telephone and Morse circuits. Whenever one wire is to be used for simultaneous telephony and telegraphy it becomes necessary to provide some means of preventing the telephone currents from passing off over the telegraph lines and thereby reducing the transmission of speech in the telephone. This is ordinarily accomplished by the use of a retardation coil connected in series in the telegraph line.

The retardation coil offers a high impedance to the high frequency telephone currents thereby preventing them from passing through to the next station, but because of the low resistance to direct current telegraph impulses allows the telegraph currents to pass on.

The condensers wired from the coil to ground are for the purpose of preventing telegraph currents being diverted from the line to ground.

Retardation coils usually employed are used purposely to choke out the telephone currents, whereas in the Seaboard circuit this is not accomplished by the repeating coil alone, but also by the telegraph relay which has a high impedance.

These repeating coils have shown up most satisfactorily for block service, where it is not of great importance if the conversation in blocks adjacent to the one in use is interfered with; it is not but if the line is quiet, conversation one or two blocks away can be faintly distinguished.

Telephone signaling is accomplished in block work in the same way as with the ordinary composite set. The operator wishing to call the adjacent block presses a button in the set which places high frequency current on the line by means of an interrupter and induction coil.

The current of the signal station passes through a condenser and howler to ground, causing the howler to produce a sufficiently loud sound to be heard in the station.

Block wire compositing differs from the ordinary through composited line in that it is only necessary to be able to talk to two adjacent blocks on either side of a tower or station at the utmost; ordinarily any operator does not talk over more than one block on either side of him. This is one reason which made it possible in our case to omit some of the apparatus usually necessary and to use repeating coils in order to divide the line into blocks. The condenser and resistance usually bridged around the telegraph keys on a composited line are omitted because a by-path around these keys is not required. In no case in block work is it ever necessary to signal telephonically past a telegraph relay.

There are two causes of trouble to be considered in reference to the telegraph circuit: (a) Drag, i. e., decrease in speed of telegraph signaling, (b) Interference of telephone signaling current with the telegraph line relays.

The increased load of the line occasioned by the introduction of the repeating coils used and one-half microfarad condensers to ground at each station, is not sufficient to cause any perceptible drag on the telegraph circuit.

The high frequency telephone signaling current from the induction coil does not interfere with the operation of the line relays at all.

In reference to the telephone circuits the following things must be considered: (a) Morse thump; (b) Interference with conversation on any block in the circuit by telephone signaling current in any other block; (c) Interference with conversation on any block in the circuit by cross-talk from conversation on any other block.

The Morse thump is at no time of sufficient intensity to be disagreeable or to interfere with the talking circuit. The howlers we are at present using are being operated on four cells of dry battery and are unnecessarily loud. These will be reduced, as under ordinary conditions two or three cells are sufficient to secure good signaling.

If it is desired to cut out one or more stations at night or extend the block during light load periods,

*Paper read at the convention of the Association of Railway Telegraph Superintendents, Los Angeles, June 20-25.

this can be done and the two blocks on either side thrown together for operating purposes. It simply becomes necessary to short circuit the apparatus (both telephone and telegraph) of the way station being cut out. On the Seaboard this is done by a small knife switch in the telephone ground to prevent a possible leakage and the wire cut out at the telegraph switchboard.

The electrical features of the telephone blocking scheme have here been given in some detail. This is in order that a fairly clear idea may be obtained as to just how the equipment is operated and the simplicity of it for the purpose. It operates with us under very severe conditions, namely the heavy load of telegraph stations along the line. If these could be cut out, and in many cases this would be possible, the grade of service would be equal to much of that obtainable today either in commercial or train despatching service. The wire could still be used for through telegraph business and undoubtedly would be so used, the advent of the telephone merely making it possible to do without the local telegraph stations.

It is not necessary to go into the advantages of this method of blocking. The same arguments apply to it as to the case of dispatching trains by teelphone and railroad men are becoming thoroughly acquainted with those. The greater speed of operation obtainable, the advantages of direct personal communication between the operators, the quicker the response to the sound of a howler or a bell than to the telegraph sounder, all of these work for the better efficiency and therefore better service.

There is another and an important advantage of this system of blocking. It enables a railroad to get one hundred per cent more service out of existing block wires. A railroad can change over a block wire telegraph line to a through circuit, while at the same time operating the blocks as efficiently, if not more so, than before. For this reason it seems worth while bringing the advantages of this system before the Association in order that, when necessity for its adoption arises, it will stand as a ready solution of a problem which otherwise might prove both complicated and expensive.

Private Car Telephones on the Lehigh

By George Harmon

IT is believed that the Lehigh Valley Railroad Company is the first to equip its private cars with telephones and provide suitable arrangements to permit connections being established with either telephone train wires or private lines, as may be desired. This latest phase of the substitution of the telephone for the telegraph for directing train movements is a further endorsement of the successful operation of the two telephone train dispatching circuits which the Lehigh Valley has had in operation for the past eight months.

Fig. 1 shows private car No. 351, of the Lehigh Valley Railroad, with the line pole attached to the wires above, and in this view also is illustrated the manner in which the portable telephone set is used.

Fig. 2 shows a closer view of the use of this instrument also taken in the interior of car No. 351. The manner in which the telephone set is hung in brackets

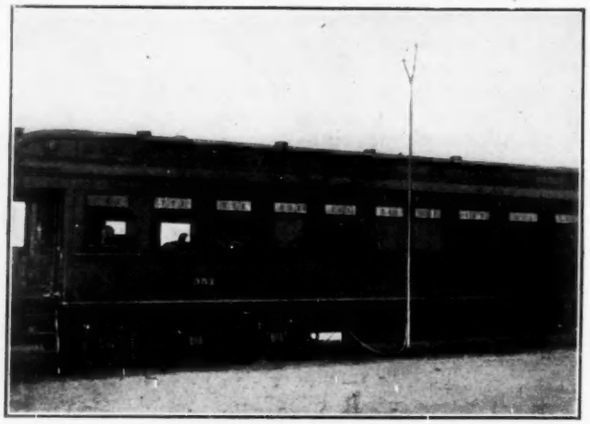


Fig. 1. Line Pole Attached to Wires.

Fig. 2. Using Portable Set in Private Car.

in the private car is shown in Fig. 3. The fourth illustration is a view of the stenographer's desk with its telephone attachment in car No. 350.

Beneath the car is a watertight box in which is mounted a flush type receptacle and a standard telephone sub-station protector. A line pole having one end of the connecting cord fitted with a plug which registers with the receptacle is used to establish connections with telephone lines along the railroad right of way. At certain stations jack boxes mounted on poles are provided and connections are then made with a cord fitted with two plugs.

A special sixteen-cycle battery-operated interrupter is used for signaling. By pressing the small button on the jack plates, as shown in Figs. 2 and 3,

the interrupter furnishes current to throw the p. b. x. switchboard signal associated with the telephone line. Battery is supplied from twenty dry cells carried beneath the car in a special holder.

At present two cars, Nos. 350 and 351, that of Mr. Middleton, the vice-president, and Mr. J. F. Maguire, the general manager, have been equipped. In car No. 350 there are three telephone stations, one in

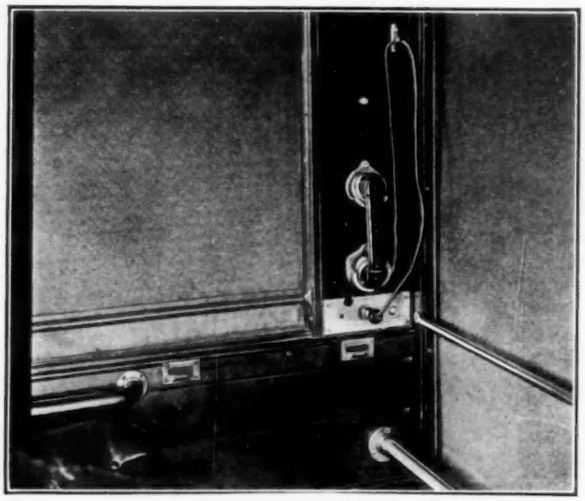


Fig. 3. Portable Set Hanging in Car.

the rear observation room, one in the vice-president's stateroom, and one at the stenographer's desk. The general manager's car, No. 351, is similarly equipped with the exception of the stenographer's desk.

Transmission tests were made between the railroad company's offices at 143 Liberty street, New

Fig. 4. Stenographer's Desk with Telephone.

York, and the cars, when stationed at Sayre, Pa., with excellent results.

The Western Electric Company furnished and installed all the equipment, which was of special design and finish to conform with the luxurious appointments of the cars.

The Santa Fe System of Circuits

We have received from the superintendent of telegraph of the Atchison, Topeka & Santa Fe Railway, Topeka, Kansas, a blue print, twenty-eight by fifty-two inches in size, showing all of the telephone and telegraph circuits found on the entire system. It not only gives a very comprehensive outline of the telegraph and telephone system of the Santa Fe, but a large amount of information regarding the various circuits as well. Western Union, joint Western Union and railway, railway copper, railway iron, Postal, joint Postal and railway and telephone wires, are all distinguished on the drawing by different kinds of lines. Distances from Chicago to the important points in the systems are indicated, also the equipment found on the different railway circuits. The Santa Fe has in operation at the present time 3,004 miles of dispatching circuits and has in process of construction 2,645 miles of new circuits. In addition there are 285 miles of second dispatching circuits in use and 158 miles more of such circuits under construction, which, together with 875 miles of railway and commercial message circuits, will increase the company's telephone system to a total of 6,969 miles.

Proposed Changes in Morgan Properties

J. P. Morgan & Co., New York, is said to be planning for the organization of a company to take over its telephone properties in Ohio outright, but it is believed the first efforts will be in the direction of improving and bringing them up to a high standard, which will require time. Among the properties mentioned are the United States Telephone Company, the Cuyahoga Telephone Company, the Columbus Citizens' Telephone Company, the Dayton Telephone Company, The Toledo Home Telephone Company, together with the various local exchanges of the United States Telephone Company and the Columbus Citizens' Telephone Company.

Santa Fe Record Order for Selectors

The largest order for Railway Telephone Selectors ever reported has just been placed by the Atchison, Topeka & Santa Fe Railroad with the Western Electric Company. The order calls for over 600 of the new selectors recently developed by Western Electric engineers. Following successful experimental installations, the New York Central and Pennsylvania Systems have also placed repeat orders for the new selector.

Caveats Abolished

Acting upon the recommendations of Commissioner Moore, Congress and the President have abolished that section of the patents statutes providing for the filing of caveats, which no doubt will be welcomed by inventors, as they were never considered of much value. A caveat is simply evidence which has been recorded for the purpose of securing to the inventor notice of the filing of application for a similar patent, all of which is covered by the application for a patent.

Automatic Indications of Trouble

By L. W. Carroll

SUCCESSFUL telephone exchange operation is contingent on being capable of giving the patrons first-class service, for which they are usually willing to pay an equitable rate. It should be borne in mind that the patrons considers poor service, may the cost of same be ever so small, little better than no service.

First-class service is dependent on the following requisites:

First: The best apparatus and line equipment.
Second: The prompt elimination of trouble.
Third: Efficient operation.

The question of what constitutes the best apparatus is one on which there is a wide divergence of opinion and which depends partly on local conditions.

The apparatus first of all should be of substantial construction and of such design as to give efficient operation. Secondly the maintenance should be as small as possible, and to this end the design should be such that, when once properly adjusted, the operation will be reliable and uniform. Thirdly the design should incorporate any features which will not only indicate promptly the existence of trouble, but will facilitate in the elimination of the same. Further mention of this will be made in connection with the elimination of trouble.

The prompt elimination of line trouble depends largely on the early report, or a prompt indication of the existence of the trouble. From the exchange manager's point of view, there are but two kinds of line trouble, viz.: that which is reported by the subscriber and that discovered by the operators or maintenance force.

Now if the system and apparatus can be so arranged that there will be an indication of trouble immediately on its occurrence, it will greatly expedite the elimination of that trouble.

To this end we have the central battery systems vs. the magneto. The usual line troubles on the system are grounds and crosses which on the magneto system will not be discovered until an attempt is made to use the line by either the subscriber or operator. This trouble on the central battery system would be indicated immediately on occurrence by a permanent signal, thus giving an hour or possibly a day's notice before the line would be required for use. The value of this feature may be appreciated from the fact that on exchanges which have been cut over from magneto to central battery, the number of cases of trouble reported by the subscriber have been reduced 60 to 75 per cent, the physical condition of the lines remaining the same in both cases.

In addition to the above we have the fuse alarm and the heat-coil alarm which tell the maintenance force that a line is open in the exchange and where it may be placed in order without delay, and before the subscriber is put to any inconvenience whatsoever. This is a long step in advance of the old style of heat-coil protection, where the coils may be out or open and so remain for days until the patron, or patrons if the line be a party line, report the trouble. It is easily conceded that 99 per cent of the open lines due to heat-coils are discovered and placed in order before the subscriber experiences any difficulty with his service. In comparison with this, we have the old type of heat-coil where 60 per cent of the open lines due to defective heat-coils are reported by the subscriber, the balance being discovered by the operators and maintenance force. Where party lines are used the speedy elimination of line trouble is of still greater importance, as each case of trouble interrupts the service of several subscribers.

A further aid to the indication of open lines is the ringing pilot lamp which indicates whether the operator is ringing on a normal line or an open line. This auxiliary ringing signal becomes almost a necessity after having once been used on a board as the operator will, when she finds an open line, immediately report the trouble to the wire chief instead of reporting "Don't answer" to the calling subscriber.

It has been found by experience that the ringing pilot reduces the number of subscribers' complaints on open lines, due to causes outside of the heat-coils, by 30 to 40 per cent.

In consideration of the foregoing it may be easily conceded that, with the proper kind of a system and the use of apparatus having the above-mentioned indicating features, a truly wonderful showing may be made as regards the reduction of the number of complaints reported by the subscriber, although the total number of cases of trouble may remain the same. Actual results obtained in an exchange of 500 subscribers, in which all of the above features were installed and with an ordinary maintenance force, were most desirable; the actual number of subscribers' complaints on grounds, crosses and open lines, were reduced to less than 20 per cent.

Another very convenient aid to "getting wise" to the trouble before the other fellow finds it is the voltmeter test. This is especially valuable in locating the trouble on magneto exchanges and toll lines.

The apparatus usually used is very simple, consisting of a voltmeter with a scale of 0 to 30, and set of 80 dry cells connected to a suitable cord and plug by a key for throwing the voltmeter across the cord, or on the tip or ring side of the cord to ground. In order to test the condition of the lines all that is necessary is for the operator to plug the test plug into the line and operate the key, taking the reading in the three different positions. If the readings are out of the ordinary the operator makes a note of the same and reports the line in trouble. All of the lines are tested in this manner during the early hours of the morning and a list of the lines in trouble is ready for the trouble man as soon as he starts the work of the day. It will be evident that this is several steps ahead of waiting for the trouble to show up during the rush hours of the day. This is especially true of toll lines as if the trouble is reported early it can many times be cleared before many toll calls are lost. In this case it will be seen that the early report and clearing of trouble means the saving of many dollars of revenue during a year.

Of Interest to the Trade

New Protected Cable Terminal

A compact, weather-proof cable terminal, affording protection to the central office equipment against lightning discharges and accidental contact with power wires has been recently placed on the market. The new terminal is designed to replace two usual types of cable terminals, namely: the compact, sheet iron hooded, but unprotected type, and the cumbersome, wooden-box type of protected terminal. This new design, the Western Electric Company's No. 18, combines the advantageous features of both of the older types.

The No. 18 protected cable terminal consists essentially of a rectangular oiled and shellacked wooden

Protected Cable Terminal, Cover Removed

Same, Cover Partly Removed.

box into which the cable is led. Two sides of this box serve as mountings for the fuse clips and as fanning strips for the bridle wires. The third side acts as a support for cut-outs. During manufacture the interior of the box is filled with water-proof pot head compound, which fills all spaces between the fanned-out wires and seals the end of the cable against moisture. The box is mounted on a cast-iron base, or bracket, in the center of which is fitted a wooden bushing for clamping the cable in place and relieving the wires of all strain.

The cable chamber, binding posts and connections are protected against weather by a heavy reinforced, galvanized sheet-iron hood which may be lifted to any height necessary to examine the fuses, etc. The hood is held at the desired height by a spring latch mounted on top of the fanning strips. However, should the hood be removed completely, it will be prevented from falling to the ground by a non-corrosive sash-chain which attaches it to the bracket.

The protective devices supplied consist of fuses and open-space, carbon-block cut-outs, two of each wired into each pair of wires, the cut-outs being connected between the fuses and the cable.

The Western Electric Company manufactures this type of protected terminal for use with No. 22 gauge wire, paper insulated, lead covered cable in capacities of from 10 to 60 pairs of wires.

Ordinarily the terminal is supplied with a six-foot cable stub, which is spliced to a cable of sufficient length to make the connection desired. However, where possible the terminal should be ordered with a cable of the required length, thereby eliminating one splice.

Kellogg Gets Cape Girardeau, Mo.

G. A. Joy, western sales engineer for the Kellogg Switchboard and Supply Company, announces the closing of a contract for a complete exchange equipment for Cape Girardeau Bell Telephone Co., Cape Girardeau, Mo.

The new switchboard and apparatus will be installed in a new building specially fitted for the service, the company having purchased the big Stone building on Broadway and Ellis street, which will be used as the central office and general offices of the organization.

The entire second story of the big building is being remodeled to suit the needs of the business. Adjoining the large operating room will be rest rooms for the operators, which will be fitted with lounges, chairs, and other comforts. The four rooms for the offices will be fitted with modern telephone office equipment. On the same floor will be placed the distributing frames, racks, storage batteries and power plant. Supply and tool room will be in the basement.

The switchboard itself is to have an ultimate capacity of 3,000 lines, a present equipment of 1,000 common battery lines; ten toll and thirty rural lines. Three sections will be installed at once.

The common battery lines are divided among six operators with two additional operators for toll and rural connections.

Each of six common battery positions will be equipped with 15 cord circuits with undivided four party keys for ringing four frequency bells on a metallic line without use of ground. The toll and rural positions will be equipped with combination cord circuits arranged to make connection between toll to toll to common battery lines.

There will be a one position chief operator, and a one position wire chief's desk; a main distributing frame, intermediate distributing frame and relay racks.

The power plant will include the furnishing of storage battery system, a mercury arc, arc rectifier, Kellogg four-frequency pole changers, two sets of transformers and slate power board. The equipment will be Kellogg standard throughout.

A Convenient Test Clip

A testing clip called the "Universal," and manufactured by R. S. Mueller & Company, at Cleveland, has a number of distinctive features which should make it an object of unusual interest to those whose work calls for the use of such a device. The fact that it is indestructible, being made of cold-rolled and blued-spring steel, is one point in its favor. In the same line may be classed its rust-proof qualities, for it is sherardized.

Another advantage is the shape of the nose. While the jaws have a spread of five-eighths of an inch, and will enclose the metal end of a telephone line fuse of the tubular type, they are thin enough to test on punchings or wire terminals set on three-sixteenths inch centers without coming in contact with the neighboring terminals and so short-circuiting the connection.

The Universal Test Clip.

While, of course, most of the testing is done by snapping the clip endways on a terminal, the jaws are provided with teeth along each side, so that the clip serves as a connector on bare wire and may also be used in close quarters where even the ordinary width of the nose would be too great. All the teeth, too, both end and sides, mesh into each other, so that the closed clip shows no interstices whatever. The advantage of this construction is that a wire will be tightly gripped no matter what its size, from the nothing up.

Not the least desirable feature of the Universal clip is that it fits the hand so nicely. A great number of telephone men are already familiar with it, but those who have not yet become acquainted will find it to their advantage to get a sample and try it.

A Ton of Platinum

It is an interesting fact, perhaps not generally known by operating telephone men, that precious metals such as platinum, gold and silver, and even precious stones, such as diamonds, are used extensively in the manufacture of telephone apparatus.

The Western Electric Company, for example, uses upwards of one ton of platinum each year.

When it is considered that the value of platinum is thirty per cent greater than that of pure gold, it will readily be seen that this expensive precious metal would not be used extensively unless results justify it.

The contact points of all Western Electric telephone apparatus are made of platinum.

Interesting Power Plant Bulletin

Bulletin No. 1008, describing telephone power plant equipments for non-multiple switchboards, has just been issued by the Western Electric Company. It contains twenty-four pages and is illustrated with many diagrams and cuts. This bulletin presents some features of Western Electric power apparatus designed especially for telephone plants. The subject matter covers only such apparatus as is required for non-multiple switchboards having capacity up to 800 lines and which have been described in three bulletins previously published. These are Nos. 1003 and 1004, Non-Multiple Central Office Switchboards, and No. 1005, Branch Exchange Switchboards.

Pennsylvania Commission Gets Telephone Report

The Pennsylvania State Railroad Commission has received the report of the experts who have been at work for weeks on a comprehensive analysis of the telephone rates and tolls throughout Pennsylvania. The experts have been working under the direction of William H. Allen, attorney for the commission.

The work is being done under a resolution of the last legislature, instructing the Railroad Commission to report to the 1911 legislature, showing the telephone charges in every community in the state. The report is comprehensive.

Independents in New York

The Independent Telephone Company has filed with the Board of Estimates, New York, application for a franchise to construct, maintain and operate electrical conductors for the transmission of electrical current for telephonic purposes through the low tension subways and to lay wires throughout the streets of the city, and construct, erect and maintain pole lines throughout the several boroughs. September 16 has been set for a public hearing of the application.

Cast Iron Permanent Magnets

A British manufacturer of permanent magnets for magnetos, instruments, etc., whose output is about 2,000 magnets per week, has invented a new process consisting in a certain heat and chemical treatment of the cast-iron magnets. The magnets thus produced are about 20 per cent less powerful than a corresponding magnet of the best steel, or 10 per cent less than the average maget, while they are claimed to be of about equal permanence. One of the advantages of this magnet is that the poles and fixing-down lugs can be cast into the desired shape all at once, while the steel magnet separate poles have to be fitted, necessitating the magnet limbs being ground and drilled.

Big Submarine Telephone Cable

Work of laying a large submarine cable has just been completed by wiremen of the East Tennessee Telephone Company, under the Ohio River at Carrsville, Ky., to give direct connection between Paducah and Evansville, Ind. The cable will open up a large territory for long-distance service from Paducah over the company's lines.

The cable is three inches in diameter, 2,500 feet long and weighs 34,000 pounds. It was shipped on a flat car, and was so heavy that no available derrick to transfer it from the car to the barge could be found. As a solution to the problem the car was pushed onto the barge. The cable holds fourteen large-size copper wires.

M. Millerand, Minister of Public Works, of France, recently announced a series of reforms for regulating the use of telephones in Paris, among them being the following: Alteration of the telephone directory, allowing subscribers to insert their vocations, office hours, etc.; abolition of the rule empowering the superintendents to deprive a subscriber of all communication without warning or explanation.

Brevities of the Business

PERSONAL NOTES.

A. S. Hallstrom, assistant sales manager of the Kellogg Switchboard and Supply Company, was married June 15 to Miss Emma A. Walther, a Chicago girl, and the happy couple at once departed for an extended trip through Wisconsin. The office associates of Mr. Hallstrom presented the bride with a handsome chest of silver. The groom is one of the most popular members of the Kellogg sales force.

H. W. Gillis, formerly manager of the Shelby County Telephone Company, Shelbyville, Ky., will engage in the electrical contracting and supply business at Mishawaka, Ind.

W. G. Rauch, Atlanta, Ga., who has been connected with the Southern Bell Telephone and Telegraph Company for a number of years, has been appointed division plant superintendent of that company, with headquarters at Charleston, W. Va.

Harley A. Seybold has been appointed manager of the Breckenridge Telephone Company, Breckenridge, Minn.

W. F. Baker, formerly division commercial manager for the New York division of the New York Telephone Company, has been appointed to the same position with the New Jersey division of the company.

J. M. Kennedy has been appointed district manager of the Missouri and Kansas Telephone Company, with headquarters at Hannibal, Mo.

H. P. Storkerson, formerly district manager for the Michigan State Telephone Company, at Kalamazoo, has been appointed to the position of superintendent of equipment, with headquarters at Detroit.

Mr. J. C. Murray, sales engineer for the Kellogg Switchboard and Supply Company, has left on a six months' business extension trip in South America. Mr. Murray expects to visit Kellogg company customers, agents and friends in all the more important cities, stopping at Bahia, Rio de Janeiro, Sao Paulo, Montevideo, Buenos Ayres, Santiago, Lima, Colon and other cities. Mr. Murray is a practical telephone man of long experience and is at the service of operating companies for information, specifications, etc. This trip will widen the already favorable opinion in which Kellogg telephones and switchboards are held in South America, as a result of their service record in actual operating. Mr. Murray has with him complete apparatus, samples and literature, including the Kellogg company's Spanish bulletin, which describes in Spanish and illustrates clearly the various types of apparatus. He will push the sale of Kellogg railroad telephones and dispatching systems, mining telephones and special equipment.

A. B. Conklin, formerly connected with the Inter-State Telephone and Telegraph Company of Aurora, and later with the Parker Construction Company of that city, has been elected vice-president and general manager of the Atlanta Telephone and Telegraph Company, with permanent headquarters at Atlanta, Ga.

Robert Merle Pike, who has been connected with the Jasper County Telephone Company, Newton, Iowa, in the capacity of wire chief for the past two years, has accepted a position as manager of the Kellogg Telephone Company, Kellogg, Iowa.

J. J. Carty, chief engineer of the American Telephone and Telegraph Company, and C. E. Scribner, chief engineer of the Western Electric Company, have received an invitation from the representative of the French government to attend the international conference of telephone and telegraph experts to be held in Paris in the month of September. This conference held its first meeting in Budapest two years ago and was attended by delegates from the various administrations, but no invitations were extended to technical men outside of government circles. A few invitations have been issued for the present session to Europeans not connected with any government, but Messrs. Carty and Scribner are the first Americans to be thus favored. The conference will discuss the standardization of telephone equipment, the relative merits of automatic, semi-automatic and manual systems, and other topics of importance to telephone engineers.

L. M. Jones has been appointed superintendent of telegraph of the Atchison, Topeka and Santa Fe Railroad, to succeed C. H. Gaunt, who has resigned to accept the position of general superintendent for the Western Union Telegraph Company, at San Francisco. Mr. Jones was formerly assistant superintendent of the Santa Fe company with headquarters at Topeka, Kans.

N. G. Hunter, Wabash, Indiana, has been elected president of the Indiana State Independent Telephone Association, to succeed Chas. S. Norton, resigned.

Charles Phillans has been appointed manager of the Bucyrus Telephone Company of Bucyrus, Ohio.

Wallace L. Cook, formerly sales engineer in the railway telephone department of the Western Electric Company, is now associated with the United States Electric Company. Mr. Cook will make his headquarters in Chicago.

IN THE MARKET.

SULPHUR WELL, KY.—Sulphur Well Home Telephone Company has just been organized here by L. Boston, S. M. Marcus and O. E. Boston, Mr. Boston being designated as manager. Capital stock, $500. A full line of construction material will be needed. Address the Sulphur Well Home Telephone Company, Sulphur Well, Ky.

KIRBYTON, KY.—The Kirbyton Home Telephone Company has just been organized here with a capital stock of $1,200. The incorporators are: J. A. Hayden, W. O. Hobbs and J. A. Martin. A local independent system will be built in Kirbyton, connecting with long distance service with Bowling Green. Complete line of construction material will be needed. Address J. A. Martin, manager the Kirbyton Home Telephone Company, Kirbyton, Ky.

ROSE HILL, VA.—The Rose Hill Independent Telephone Company is being organized here by F. H. Hart and others for the purpose of building a local independent system in Rose Hill and Lee county. An exchange will be built in Rose Hill. Construction material will be needed. Address Rose Hill Independent Telephone Company, Rose Hill, Va.

JAMESTOWN, KY.—The Russell County Home Telephone Company, recently organized here, has increased its capital stock from $1,000 to $2,000 and will construct considerable new lines in and around Jamestown. All construction material will be needed. Address the Russell County Home Telephone Company, Jamestown, Ky.

BARDSTOWN, KY.—The Nelson Telephone Company, recently organized here will build both local and long distance lines from Bardstown via Lebanon to Shelbyville, forming an important connection. An increase in capital stock will be made. Construction material will be needed. Address the Nelson Telephone Company, Bardstown, Ky.

CONFLUENCE, KY.—A. B. Smith and others here are preparing to organize to build a telephone system in Confluence. All the necessary material will be needed. Address A. B. Smith, Confluence, Ky.

CORNETTSVILLE, KY.—The Perry County Telephone Company here announces some extensions in its lines, all of which will require considerable construction material. One line will be built from Cornettsville to Hazard, and from Hazard to Jackson. All construction material will be needed. Address the Perry County Telephone Company, Hazard, Ky.

WASIOTO, KY.—The Bell County Home Telephone Company has been organized here by T. J. Asher, J. M. Asher and others with a capital of $1,000. Objects and purposes to build a local independent system in Wasioto, with an exchange, also long distance line from Wasioto to Harlan and Poor Fork, Ky., 30 miles, into the Upper Cumberland coal fields. A full line of construction material will be needed. Address the Bell County Home Telephone Company, Wasioto, Ky.

CORBIN, KY.—The Corbin Telephone Company, organized here several months ago, has increased its capital stock from $3,000 to $4,000 and is securing right-of-way for the construction of a local independent line from Corbin via Williamsburg to Jellico, Tenn., 45 miles, completing long distance connection with the coal fields around Jellico. The company also will make some extensions around Corbin. A larger switchboard will also be purchased for the Corbin

exchange. A complete line of construction material will be needed. Address the Corbin Telephone Company, Corbin, Ky.

London, Ky.—The London Telephone Company is securing right-of-way for the construction of a local independent line from London via Lily and McWhorter to Barboursville, 25 miles, and makes the announcement that a full line of construction material will be needed. Lines in London will be overhauled and repaired. Address London Telephone Company, London, Ky.

Ritchie, Ky.—Henry Callahan and others of Ritchie are organizing for the purpose of establishing and building a local independent telephone system in Ritchie. Connections will be made with Hazard. Material will be needed. Address Henry Callahan, Ritchie, Ky.

Hyden, Ky.—The Leslie County Telephone Company here is in the market for the purchase of a switchboard for the Hyden exchange, also material for the construction of new lines in Leslie county, aggregating some fifty miles. One line will be constructed from Hyden via Confluence to Wooten's Creek. Address Leslie County Telephone Company, Hyden, Ky.

Poor Fork, Ky.—The Wisconsin Steel Company has taken over the Upper Cumberland River Telephone Company's lines and will overhaul and repair them, establishing long distance connection with the Harlan Telephone Company. A complete line of material will be needed, as well as switchboards for exchanges at Eolia and Poor Fork. Address Upper Cumberland Telephone Company, Poor Fork, Ky.

Grundy, Va.—The Grundy Home Telephone Company has recently been organized here by G. T. Hawkins, Jr., L. W. Farley and others for the purpose of establishing and building a telephone system in Grundy and Buchanan county. The capital stock is $2,000. The main line will be constructed from Grundy via Dante to St. Paul, Va., 32 miles. Construction material will be needed. Address the Grundy Home Telephone Company, Grundy, Va.

Middlesborough, Ky.—The Ken-See Telephone Company, recently organized here, will construct lines from Middlesborough via Corbin and Jellico, Tenn., to Knoxville, Tenn., and from Middlesborough via Livingston and Stanford to Lexington, Ky., both long distance lines, forming important connections. Construction material will be needed. Address Ken-See Telephone Company, Middlesborough, Ky.

Willisburg, Ky.—Willisburg Telephone Company organized here by W. R. Walling, L. S. French and others with capital stock of $1,000, for the purpose of building an independent telephone system in Willisburg. A full line of construction material will be wanted. Address Willisburg Telephone Company, Willisburg, Ky.

Winchester, Ky.—East Tennessee Telephone Company will build double line from Winchester via Stanton to Clay City, Ky., 50 miles. Construction work to be begun at once. Material will be needed. Address East Tennessee Telephone Company, Winchester, Ky.

Jackson, Ky.—Jackson Independent Company here will be in the market for a switchboard for their Jackson exchange, also material for the construction of lines under way. One line will be built from Jackson via Quicksand and Buckhorn to Hazard, 35 miles. Address Jackson Independent Telephone Company, Jackson, Ky.

Paintsville, Ky.—The Big Sandy Telephone Company here is securing right-of-way for the construction of lines to Jennie's Creek and Peach Orchard. Construction material will be needed. The company recently increased its capital stock from $4,000 to $5,000. Address the Big Sandy Telephone Company, Paintsville, Ky.

NEW TELEPHONE COMPANIES.

Bay Minette, Ala.—Articles of incorporation have been filed for the Alabama Telephone and Telegraph Company with a capitalization of $5,000. The incorporators are Ellis L. Munna, Spalding Peck, and J. H. Haswell. Mr. Haswell is manager of the company.

San Francisco, Cal.—The Bay Cities Home Telephone Company has been incorporated with a capital stock of $20,000,000 by James Lanagan, Guy Knupp, H. T. Bailey, C. F. Moeler and others.

Ilderyon, Ont., Can.—Articles of incorporation have been filed for the United Telephone Company with a capital stock of $40,000.

Eureka, Cal.—The Del Norte People's Telephone Company is the name of an organization recently incorporated by a number of citizens of Humboldt county, with a capital stock of $10,000.

Los Angeles, Cal.—The Sunland Rural is the name of a new telephone company incorporated by Philip Begue, C. B. Johnson, W. H. Mears, J. L. Hauber, and W. B. Blumfield, all of this city, with a capital stock of $10,000.

Vandalia, Ill.—The Fayette County Telephone and Telegraph Company has been incorporated with a capital stock of $48,500 by Wm. M. Crouch, J. U. Metzger and others.

Newburgh, Ont., Can.—The Canadian Independent Telephone Company, Ltd., has been incorporated with a capital stock of $7,500.

Goderich, Ont., Can.—Articles of incorporation have been filed for the Goderich Rural Telephone Company, Ltd., with a capital stock of $5,000; also the Metcalf Rural Telephone Company, Ltd., Metcalf, capital, $3,000; the Lake of Bays and Haliburton Rural Telephone Company, Ltd., of Dorset, capital stock, $3,000.

Helena, Ark.—S. Straub, E. M. Allen and others have incorporated the Lake View Telephone Company with a capital stock of $10,000.

Reading, Kans.—The Lyon County Home Telephone Company has been incorporated by J. F. Clark, W. E. Loomis, W. C. Simpson, D. D. Elliott and D. Nickel of Reading; and Thos. Evans, Hartford, and G. C. Thompson of Barkley. The capital stock is $1,000.

Lake Charles, La.—Articles of incorporations have been filed for the North Calcasieu Telephone Company by W. B. Welborn, Jr., president; M. A. Shirley, vice-president; C. M. Green, secretary; S. J. Andrews, treasurer. The capital stock is $10,000.

Augusta, Mich.—A charter has been granted the Augusta Telephone Company. The capital stock is $6,000 and the incorporators are Nelson V. Bird, Charles Case and H. J. Richardson.

South Haven, Mich.—The Citizens' Telephone Company of South Haven has been organized with the following officers: President, George C. Moore; vice-president, J. J. Clement; secretary, E. J. Berge; treasurer, A. R. More; capital stock, $25,000.

Bridgeman, Minn.—The May Northern Telephone Company has been incorporated with a capital stock of $10,000 by John C. Martin, president; F. D. Newkirk, vice-president; E. Dalley of Pillager, secretary; J. M. Schmit, treasurer.

Kerkhoven, Minn.—The Kerkhoven-Louriston Telephone Company has been incorporated with a capital stock of $5,000 by William Strom, Otto Strom, Fred Armstrong, Ole Mathiason, G. W. Holmgren, and J. H. Lewis, R. F. D. No. 2, Murdoch, Minn.

Greenfield, Mo.—J. C. Shrouse, J. F. Wetzel, R. S. Long and others have incorporated the Mutual Telephone Company with a capital stock of $20,000.

Butte, Mont.—Articles of incorporation have been filed for the Havre Electric, Steam Heat and Telephone Company with a capital stock of $100,000. The incorporators are J. K. Heslet and C. C. Swinborne, of this city.

Hershey, Neb.—T. A. Roberts, D. E. Martin and W. J. Shingle have incorporated the Rosedale Telephone Company with a capital stock of $5,000.

Rossie, N. Y.—The Rossie Telephone Company is the name of an organization incorporated by Cornelius J. Crowley, William Simmons, Delbert Hunter, Francis J. Kelly, James Pound, John Mullen, Jr., and Daniel Phalen, who are also directors of the company.

Colden, N. Y.—The Colden-West Falls Telephone Company has been incorporated by C. N. Darbee, West Falls; C. S. Rich, Springville; J. G. Sigler, East Aurora. The capital stock of the company is $7,500.

Siler City, N. C.—The Bonlee Telephone Company has been incorporated by C. N. Bray and others with a capital stock of $15,000.

Medina, Ohio.—The Medina County People's Telephone Company has been incorporated by C. P. Dickorman, M. E. Branch, C. E. Jones, Charles Matthew, S. W. Batchell and others; capital stock, $50,000.

Woburn, N. D.—The Western Rural Telephone Company has been incorporated by Donald Stewart, Chas. Haberle, C. L. Kreisel, and Adam Berge of Flaxton and J. E. Pfeifer of this place; capital stock, $5,000.

OVERLY, N. D.—Fred E. Sims, John Schichard, Chris. Foss, Peter Boardman, T. E. Morgan and others have secured a charter for the Overly Farmers' Telephone Company which has been incorporated with a capital stock of $25,000.

STANLEY, N. D.—Articles of incorporation have been filed with the secretary of state for the Sunny Center Telephone Company by Peter C. Olson, and Amos E. Lande of Belden and Dayton H. Doty, Martin Holter and G. J. Gilbertson, of this city.

SALEM, ORE.—The Salem-Fairfield Telephone Association has been incorporated by M. W. Mahony, Fairfield; George W. Weeks, Salem; Alexander Harold, Brooks.

GOULD, OKLA.—The Gould Telephone Company has been incorporated by L. M. Morris, G. M. Moon, C. H. Earnest, S. A. Davidson, J. G. Luvis

OKLAHOMA CITY, OKLA.—The L. K. Sharpe Concrete Telegraph, Telephone and Railway Pole Company has been incorporated with a capital stock of $25,000. The new company, which has exclusive rights for Oklahoma, will manufacture hollow concrete poles. A site has been secured and a factory will be erected at a cost of $15,000. L. K. Sharpe, of Vicksburg, Mississippi, is sole owner of the enterprise.

AMITY, PA.—Articles of incorporation have been filed for the Amity Farmers' Telephone Company with a capital stock of $5,000. The directors are H. W. Horn and others.

MARIANNA, PA.—The Marianna and Scenery Hill Telephone Company has been incorporated with a capital stock of $7,500 by J. W. Shidler, F. G. Fulton, Chas. Wonsettle.

MOUND CITY, S. D.—The Mound City and Glenham Telephone Company has been incorporated by Gains Folde, H. G. Fenske, Mound City; G. E. Brorby, Nels J. Amundson and Hubert Truyers, Glenham. The capital stock is placed at $25,000.

CROSSPLAINS, S. D.—J. H. Weber, Hubert Weber, and Lawrence Schilmgen, of Parkston; G. Hoffman and Henry Kurtenbach, of Ethan. The capital stock is $50,000.

VIVIAN, S. D.—Articles of incorporation have been filed for the Vivian-Fort Pierre Telephone Company with a capital stock of $5,000, by Warren Young, Frank Whalen, and Zack Sutley of Fort Pierre and Arthur Morse and Rube Wood of Vivian.

ELDERON, WIS.—The Elderon Telephone Company has been incorporated by A. J. Plowman, F. E. Bump and H. H. Munson; capital stock, $10,000.

CODY, WYO.—Articles of incorporation have been filed for the Shoshone Valley Telephone Company with a capital stock of $25,000. The directors of the company are Len L. Newton, Charles Arthur Evans, Milo M. Harding, Burton W. Baker, Fred C. Barnett, all of Cody.

FINANCIAL ITEMS.

GRANT, FORK, ILL.—The Grant Mutual Telephone Company has increased its capital stock $1,200.

PITTSFIELD, ILL.—The stockholders of the Pike County Telephone Company have increased the capital stock of the company from $75,000 to $100,000.

OSAWOTOMIE, KANS.—At a recent meeting of the stockholders of the Farmers' Mutual Telephone Company it was decided to increase the capital stock to $15,000, making $10,000 preferred stock bearing 6 per cent interest, stock to run ten years.

LINCOLN, NEB.—The Lincoln Telephone and Telegraph Company has filed amended articles of incorporation with the county clerk increasing the capital stock to $2,500,000, one-half of which is preferred and one-half common. The preferred stock is to pay 6 per cent interest, payable quarterly which is to be paid after all expenses and fixed charges are paid and is to be the first lien on the earnings and assets after these charges are settled.

CRETE, NEB.—The State Railway Commission has granted the Crete Telephone Company permission to issue $50,800 of stock to cover the purchase of farmers' lines and for improving the system.

LOWVILLE, N. Y.—The capital stock of the Black River Telephone Company has been increased from $50,000 to $200,000.

WILLOUGHBY, OHIO.—The Willoughby Telephone Company has increased its capital stock from $10,000 to $25,000.

KRUMSVILLE, PA.—The Kutztown Rural Telephone Company has amended its charter permitting the company to double its capital stock, it now being $20,000.

JAMESTOWN, KY.—The Jamestown Telephone Company has increased its capital stock from $1,000 to $2,000 for the purpose of making extensions.

SOMERSET, OHIO.—The capital stock of the Somerset Telephone Company has been increased from $25,000 to $35,000.

MONROVIA, IND.—The capital stock of the Monrovia Telephone Company has been increased to $5,000.

SOMETSET, PA.—The capital stock of the Somerset Telephone Company has been increased from $60,000 to $200,000.

WINDBER, PA.—The Windber Telephone Company has increased its capital stock from $25,000 to $50,000.

NEKODA, PA.—The Pfoutze Valley Company has increased its capital stock from $5,000 to $40,000.

WENATCHEE, WASH.—The stockholders of the Farmers' Telephone Company are arranging to increase the capital stock of the company from $50,000 to $150,000.

LARSEN, WIS.—The Larsen Telephone Company has filed an amendment to its charter increasing its capital stock from $10,000 to $15,000.

PULASKI, WIS.—The Pulaski Merchants' and Farmers' Telephone Company has filed an amendment increasing its capital stock from $5,000 to $10,000.

JACKSON, MICH.—The capital stock of the Jackson Telephone Company has been increased from $4,000 to $6,000.

FRANCHISES ASKED AND GRANTED.

RED BLUFF, CAL.—The city council has granted Joseph Tait a franchise to install a telephone system in this place. He will also seek a franchise to construct lines in the county.

NEWTON, IOWA.—The Jasper County Telephone Company is seeking a new 20-year franchise with the privilege of increasing its rates.

ABIE, WIS.—The city council has granted a 20-year franchise to the Farmers' Telephone Company to construct and maintain a local telephone system.

CHEWELAH, WASH.—John S. Diedrich of this place has been granted permission by the county commissioners to construct telephone lines along the country roads.

MISCELLANEOUS.

DENVER, COLO.—The Colorado Telephone Company has secured a site at the corner of Champa and Downing streets on which it will erect a central telephone exchange. Work on the new building, however, will not begin until next year.

LEWISTON, IDAHO.—Ray Johnson, district manager for the Pacific States Telephone Company, announces that $25,000 has been appropriated by the company for enlarging and improving the systems in Lewiston and Clarkston.

MURPHYSBORO, ILL.—The Ohio and Mississippi Valley Telephone Company contemplates the expenditure of $30,000 in the improvement of its Marion system by completely overhauling it.

CHICAGO, ILL.—The Chicago Telephone Company is about to construct a sixteen-story office building on the north side of Washington street just west of Fifth avenue, representing an investment of $1,250,000.

NAUVOO, ILL.—The Nauvoo Telephone System has been purchased by O. F. Berry, of Carthage.

SOUTH BEND, IND.—The Home Telephone Company of Elkhart county has taken over all the business of the Bell Telephone Company in Goshen and Elkhart and in the rural districts of Elkhart county, for a consideration of $35,000.

IOWA FALLS, IOWA.—The Iowa Telephone Company recently purchased the plant of the Iowa Central Telephone Company operating exchanges at Eagle Grove, Hampton and Iowa Falls, and toll lines connecting these places. The transaction involves $85,000 and the purchasing company assumes the debts and bonds of the merged company.

HAMPTON, IOWA.—The Iowa Telephone Company which recently took over the Iowa Central Telephone Company's property in this city announces that it will at once begin the erection of a modern new telephone building.

HUMBOLDT, KANS.—The Humboldt Telephone Company will completely rebuild its system.

LATHROP, MO.—The Clover Leaf Telephone Company is planning to place its wires in the business part of the city in cables.

JENA, LA.—The Southern Telephone Company of Fordyce, Ark., has filed for record in this city a mortgage for $154,000 in favor of the Dosha Bank and Trust Company, the money thus obtained to be used in extending its system.

Flat River, Mo.—The Farmington Telephone Company was recently purchased by the Lead Belt Telephone Company which has ended a telephone war of eighteen months' duration. The consideration was $65,000. The directors of the Farmington company are H. D. Reuter, W. A. Mitchell, W. J. Layne, A. W. Armbruster, C. R. Pratt, C. G. Carr, Philip Grandhomme, Joseph Hague and J. W. Covington.

Holdrege, Neb.—The Phelps County Telephone Company, including local telephone exchange, franchise and trunk lines to other towns, has been purchased by W. C. May of Gothenberg. The consideration was $45,000. The company has a list of over two thousand subscribers in this city and vicinity.

Sutton, Neb.—The Sutton Telephone Company will erect a new exchange building.

Exeter, N. H.—The People's Telephone Company has been purchased by the New England Telephone and Telegraph Company. The deal covers the property, franchises and rights of the company.

Franklin, N. H.—The Citizens Telephone Company is planning to extend its system.

Ashland, Ore.—The Midway Telephone Company operating between Ashland and Klamath Falls has been purchased by the Pacific States Telephone Company.

Albany, N. Y.—The New York Telephone Company has filed a certificate with the secretary of state to the effect that it has merged the New York and Pennsylvania Telephone companies.

Ravena, N. Y.—At a recent meeting of the directors of the State Telephone Company a merger of the Ravena and Medway Telephone Company with the new corporation was effected, the new company having acquired control of all the stock of the former corporation.

Lebanon, Ohio.—The Valley Telephone Company has absorbed the local interests of the Central Union Telephone Company which means the transfer of $10,000 worth of Bell property to the Valley company, together with 300 subscribers, making the latter a total of 2,000 in Warren county.

Gallipolis, Ohio.—Cyrus Ruling, of Columbus, was recently appointed receiver for the Gallipolis Telephone Company. The company will be sold.

Altus, Okla.—The Leger and Chickasha Telephone Company and the Mangum and Quanah Telephone Company have been purchased by the Pioneer Telephone Company for a consideration of $90,000. The sale covers in all eleven exchanges and seventeen toll lines, all having headquarters at Altus. The company will make extensive improvements.

Beaufort, S. C.—The People's Telephone Company has been purchased by S. A. Agnew, of Brunson and S. Reid Fits, of Hampton, president and treasurer, respectively, of the Carolina Telephone Company, operating in Hampton county.

Watertown, S. D.—The Dakota Central Telephone Company has completed extensive plans for the improvement of the outside equipment of its exchange at this place.

Pierre, S. D.—The Dakota Central Telephone Company has been awarded the contract for installing a telephone system in the capital, by the State Capital Commision.

Jackson, Tenn.—The Stantonville Telephone Company has moved its headquarters to Corinth, Miss.

El Paso, Tex.—The Tri-State Telephone and Telegraph Company, which was recently incorporated with a capital stock of $1,000,000, has taken over all the properties of the Southwestern Telegraph and Telephone Company in northwest Texas and all the Bell lines in Southern New Mexico and Western Arizona and arrangements have been made for the transfer to the new company of all Bell franchises and rights in the territory. The company will extend its lines throughout the territory named. It will form the connecting link between the Southwestern and Colorado companies. Eventually the lines will be extended to Los Angeles and other Pacific coast cities.

Spokane, Wash.—The Pacific Telephone and Telegraph Company contemplates the expenditure of $700,000 in the improvement of its local system.

Wheeling, W. Va.—W. C. Handlan and J. W. Ewing have been appointed receivers for the National Telephone Company by Judge A. G. Dayton, Philadelphia, upon action of Andrew J. Howard, of Indiana, a stockholder of the company. It is alleged in the application that the Continental Telephone Company procured $10,000,000 in stocks of the National without any consideration, that the officers of the National were to be turned out and its business conducted along other lines than those formerly pursued.

Elgin, Tex.—The Elgin Automatic Telephone Company has been sold by Receiver W. B. Culp to Mrs. W. H. Rivers for a consideration of $6,500.

Madison, Wis.—Representatives of 100 telephone companies in this state recently met in this city and organized the Wisconsin State Telephone Association. It is the purpose of the association to advance the general interest of the telephone companies and especially to oppose the enactment of laws detrimental to them.

Spokane, Wash.—A deal was recently consummated involving the transfer of more than 1,200 miles of long distance connection and property valued at a million dollars through the purchase of the Interstate Telephone Company, Limited, by the Interstate Consolidated Telephone Company. The deal was made by Thaddeus S. Lane, president of the Consolidated company; Patrick Wall and John F. Davis, of Butte Mont., and A. H. Cook of Helena, Mont., all of whom are directors in the new incorporation.

Las Animas, Colo.—The Colorado Telephone Company contemplates the expenditure of $24,000 in improving its plants in Las Animas, Lamar and Holly, as well as other plants in the Arkansas Valley.

Tyler, Tex.—The Banner Telephone Company will make important improvements and will also extend its system to neighboring towns and villages.

Georgetown, Tex.—The Georgetown Telephone Company will erect a new exchange building.

Dalhart, Tex.—The Dalhart Telephone Company has been purchased by Messrs. Hazleton and Spain, owners of the Trans-Canadian Telephone Company. The new owners will thoroughly overhaul the system, making it thoroughly modern and up-to-date in every respect.

Lemon, S. D.—The Home Telephone Company has been purchased by the Dakota & Montana Telephone Company, Hettinger, N. D.

Spokane, Wash.—Plans for relieving the congested telephone situation in Spokane, due to the rapid growth of the city during the last few years, have been perfected in part by the Pacific Telephone & Telegraph Company, which is preparing to erect a $45,000 sub-station in the Union Park district and install more than $200,000 worth of new equipment in the local exchanges. The contract has been let to J. W. Forrest and work will be started immediately. The company is planning other extensive improvements, including equipment for the central office which will cost about $55,000. Besides this work the company plans to install additional conduits, cables and outside wires at a cost of $200,000 which will bring the expenditure for this year to $300,000 if the plans are carried out.

Spokane, Wash.—Through a traffic arrangement which has been effected between the Home Telephone Company and the Interstate Telephone Company, both of Spokane, there has been brought about the consolidation of invested interests, amounting to more than $2,000,000, in eastern Washington, western Montana and Idaho. This gives the Interstate company exclusive connection with the Home company's exchange at Spokane for the interchange of long distance business between that city and all points on the Interstate company's lines in the territory above mentioned and all territory hereafter acquired.

The Interstate company at present has 2,500 telephones installed, covering territory within a radius of 150 miles of Spokane and 1,200 miles long distance circuits, and the Home company expects to have 5,000 automatic instruments in use by January 1, 1911, when the franchise becomes effective, after which time it is claimed telephones will be installed at the rate of 1,000 a month. The Interstate system will be changed to the automatic. Thaddeus S. Lane is president.

Butte, Mont.—At its annual meeting the Montana Independent Telephone Company elected the following officers: President, Thaddeus S. Lane; vice-president, W. H. Hall; secretary and treasurer, John F. Davies; directors, the above officers and C. J. Kelley, M. S. Largey, Patrick Wall, C. F. Kelley, G. E. Blackburn, A. B. Cook, H. A. Gallwey, James A. McKee, C. S. Jackman and L. O. Evans.

Missoula, Mont.—The Montana Independent Telephone Company is constructing a new copper long distance line between Deer Lodge and Missoula, also between Stevensville and Hamilton.

Wellsburg, W. Va.—A deal has just been closed whereby the Wellsburg Home Telephone Company has taken over the lines of the Chartiers Telephone Company, which lie in this state.

Eau Claire, Wis.—The Wisconsin Telephone Company contemplates the expediture of about $15,000 on its local plant and about $8,000 at Chippewa Falls.